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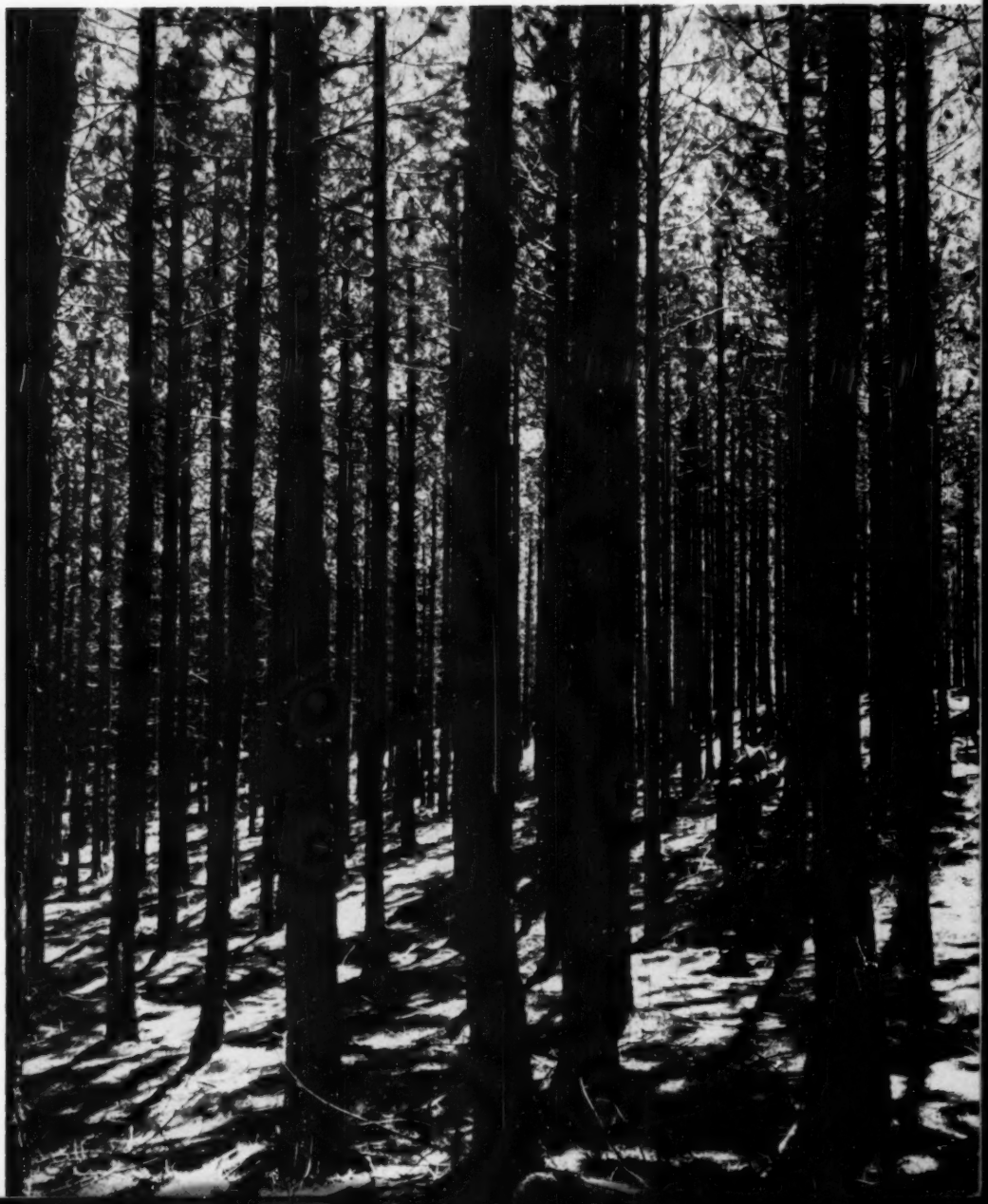

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Journal of Forestry

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The Place of Forest Recreation in the American Foresters' Professional Field[1]

Shirley W. Allen
School of Natural Resources, University of Michigan, Ann Arbor.

IT IS PROBABLY TRUE that not every professional forester and probably not half of all who practice forestry professionally are tolerant of outdoor recreation as a justifiable use of forest land. Still fewer will defend and promote such use if there appears to be any vigorous conflict between it and other of the recognized uses — timber production, grazing, regulation of stream flow (I leave out production of wild animal life because it serves recreation principally). When it comes to battling for exclusive use of forest areas for recreation and inspiration, the forester group is still smaller and the area they would select is relatively small. Does such a picture square with Canons 1 and 3 of our Code of Ethics?

When it comes to actual possession of "Knowledge" (this word is used in Canon 1) of recreation and of the particular satisfaction which people seek from it in a forest, our habit of specialization has hardly helped the professional forester to be understanding, sympathetic, and expert in matters of selection of sites, furnishing of facilities, and assuring good out-door house-keeping on the properties under his charge. The days of lush funds and special landscape architects to help with planning and construction seem to be gone. While, I am not sure that those days were an unmixed blessing, their loss means that foresters in general must take over.

There are a considerable number of foresters who have no taste for the sort of out-door recreation appropriate in a forest setting. At best these foresters may do a little hunting or fishing but would probably be insulted if someone said they were indulging in recreation — No, they were hunting and fishing. But one would hardly be fair to say that he who has no taste for recreation *need not* engage in such recreation activities in order to learn how to administer the forest recreation resources in his care. On the other hand, one might generalize to the extent of saying that to appreciate the necessity for play one should himself play a little.

Philosophically one meets a statement from the forester suggesting certain legal and economic principles governing forest recreation that "Costs (of providing for recreation enjoyment) should include the value of any sacrifices necessitated in other uses."

One may well ask. Is this the practice in other kinds of natural resource cost accounting? Does one for instance charge to the dedication of land exclusively to timber growing, grazing, or regulation of stream flow an amount which might (by some means or other) be estimated to represent the interferences of these uses with recreation?

Important enough to be number two among things which need to be done in long range planning for use of leisure is a paragraph from *A Mid-Century Declaration of Recreation Policy,* proposed by the National Recreation Policies Committee:

"Continued conservation of natural resources, which may be utilized as one of their highest purposes for qualitative recreation for all the people. These resources include our forests, mountains, waterways, beaches, places of inspiring natural beauty, historic sites, and wildlife."

Certainly forests, mountains, and waterways in general, and many places of inspiring natural beauty in particular, are resources with which the forester deals by the very nature of his calling and if he doesn't see to their "continued conservation" some one less appropriate and less able will have to do it.

What I am attempting to lead up to is the question of the professional foresters' attitude toward recreation use as a major use of the forest, not as a frill and an extra. How bold should he be? Should he be allowed to get away with a contemptuous attitude or a lack of interest?

My answer to these questions would be, respectively: "Plenty bold" and "No."

In other words it seems to me that the forester must be a "man of parts" and that he can no more brush off a consideration of recreation use as something he must understand, promote, and perhaps regulate, than he can be a good silviculturist and ignore the disposal and use of the wood he helps to produce.

Almost any forest land that is at all attractive will be used for some recreation. Skill and knowledge must accomplish two things: (1) Make the land serve up good recreation; (2) see that recreation does not destroy the resource it depends on. The forester can escape neither of these duties.

[1]Paper presented at a meeting of the Division of Forest Recreation, Society of American Foresters, Washington, D. C., December 15, 1950.

Control of Growing Stock in Even-Aged Stands of Conifers

F. G. Wilson

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DESPITE ALL that has been written about thinning in the United States, no agreement has been reached on optimum range of stand densities, nor on the yardsticks to be applied. With the hundreds of thousands of acres that have been planted in the last few decades, it is time to adopt standards which will define chosen practices and permit comparison of results. In Wisconsin alone, 180,000 acres have been planted on state, county, and industrial forests in the past 25 years. There are older plantations, ready for commercial thinning, which should be operated as pilot plants to guide management of the large acreage with which foresters soon will be confronted.

To be as specific as possible, this discussion is limited to pure, even-aged stands of conifers. Although original data are limited to one state forest plantation of red pine at Star Lake in northern Wisconsin, its history is fully known to the writer who has followed the development of this stand from the time the seedlings sprouted in the nursery. (See cover photo.)

Commercial Thinning

Let us first consider a few principles, most of which are generally accepted:

1. Heavier stand density is maintained for tolerant than for intolerant species.

2. Heavier density is maintained in humid than in arid regions where root rather than crown completion is the limiting factor.

3. Plotting yield table values for number of trees over height, rather than over age, permits comparison of stand densities for each site quality (*4*). Such graphs reveal that higher density is maintained on good than on poor sites. This makes sense, since quality is unobtainable on poor sites and the main consideration is to grow trees of merchantable size without too long a rotation.

4. The same species may be thinned more heavily by a paper company, concerned only with volume and short rotation, than by an owner successively cutting pulpwood, poles, piling, and saw logs.

5. Accessibility governs the period between thinnings. Less accessible stands will be thinned more heavily and left to grow more dense than similar stands where easy access permits taking smaller cuts.

6. The old adage "markets govern silviculture" has marked application to commercial thinning practice. Note how the lack of Kraft process pulp mills and the declining market for box lumber in New England have lead to emphasis on pruning and favoring of final crop trees. This "crop tree" concept is now being stressed in regions where its application is less valid.

As to timing of thinnings, there is no reason for thinning at regular intervals of 5 to 10 years, just because yield tables are given in that form. A well-known rule admonishes us to thin at shorter intervals in young stands than in old stands. This is based on two facts which lead to rapid crown closure in youth.

1. The holes in the crown canopy, resulting from early thinnings, are comparatively small.

2. Height growth is more rapid in youth.

The latter fact points to the use of height growth to time thinnings. An abtract (*1*) of a British publication on thinning of plantations states: "It is important to repeat thinnings frequently in the stage of rapid growth, and a rough working rule is that repetition is necessary after trees have grown at most an additional 10 ft."

Just what this figure should be again depends on accessibility and the minimum acceptable cut. Table 1 shows that an added 7 feet of height, with thinning to the same density, yielded 6.7 cords of pulpwood. This plantation has twice fallen on the line for site 65 of the site index graph (*2*). Should it continue to follow that line, then using values of 7 or 8 feet of height growth would result in a perfect arithmetic progression of 5,- 6,- 7,- etc. to 12-year intervals. By following this schedule, thinnings and stand data tabulations would also fall at 50 and 100 years from seed.

Crown Classes

Both cuts in the Star Lake plantation (Table 1) were commercial thinnings with major consideration given to spacing. While they were not thinnings from below, but left openings in the crown canopy, it was also desired to eliminate trees which were suppressed beyond the point of recovery. Such fictitious growing stock is not working and should not be listed on the payroll. It is also less work to erase these small trees with the axe than to keep records on them. Only 9 of the 72 trees below 4.0 inches d.b.h. survived the first thinning. At the same time, both genetics and the need for some sticks of good size in the pulpwood pile, called for removal of large trees with coarse branching. Reference to Table 1 shows that the diameter range of the cut trees was narrower for the second thinning, most of the small, week, or large, coarse trees having been taken in the first cut.

The trees were graded according to the tree classification for this species in the Lake States (*4*). As would be expected in a relatively young plantation, there were no head dominants. Crown classes ranged from 2a to 6c. After the second thinning only six weak codominants and one intermediate were left. There was no mortality on the thinned plot during the 5-year interval, while 20 trees died on the check plot.

Stand Density in Terms of Spacing

Because natural stands are characterized by openings and crowded groups, practicing foresters have turned to spacing rules as guides

TABLE 1.—STAR LAKE PLANTATION—SUMMARY TABLE—RED PINE—PERMANENT SAMPLE PLOTS—ONE ACRE

	Height Dominants	Height All trees	D.b.h. Range	D.b.h. Av. tree	Number of trees	Stand density	Bole area	Basal area	Yield Total	Yield Peeled merch.	Yield Cords rough	Yield Sawtimber
	Feet		*Inches*			*Percent*	*M. sq. ft.*	*Sq. Ft.*	*Cubic ft.*			*Board feet.*[1]
CHECK PLOT												
Age 30	42	40	1.0-9.2	6.0	893	16.6	30.6	172	2,842	2,426	34.9	1,770
5-Year increment				.4				22	731	730	9.5	2,390
Age 35, live trees	49	46	2.1-9.5	6.4	873	14.4	36.7	194	3,583	3,156	44.9	4,160
Mortality			1.0-4.4	3.1	20			1	6	3	0	0
THINNED PLOT												
Age 30	42	40	1.8-9.9	6.2	836	17.2	29.5	174	2,885	2,484	35.9	2,770
Cut in thinning			1.8-9.0	5.0	256			34	539	400	5.9	120
Residual stand	42	41	3.0-9.9	6.6	580	20.6	22.4	140	2,346	2,084	30.0	2,650
5-Year increment				.5				22	771	736	9.0	3,330
Age 35	49	47.5	3.1-10.7	7.1	580	17.7	28.0	162	3,117	2,820	39.0	5,980
Cut in thinning			3.1-8.8	6.0	150			30	538	466	6.7	450
Residual stand	49	48.5	5.0-10.7	7.5	430	20.6	22.4	132	2,579	2,354	32.3	5,530

[1]Decimal C rule.

to marking in thinning. Though the amount of growing stock on an acre may be ideal, the crowded groups still require thinning. Nor can spacing be ignored on experimental plots; a reasonably uniform distribution of the trees over the area is essential.

Spacing rules are derived from two factors, one of which must be the number of trees per acre. The other may be diameter or height. The writer (*9*) has advocated the use of height because it is less affected than diameter by past history of spacing. Subsequently, Gevorkiantz (*3*) cited prior use of alignment charts based on height as a guide to thinning in Java. The formula offered by the writer was:

$$n = \frac{43\,560}{(hf)^2}$$

where n is the number of trees per acre, h is the height of the stand and f is a fraction or percentage of height. The lines for values of f provide a reference grid (Fig. 1) on which the thinning schedule for Star Lake is shown.

The first thinning was guided by judgment but was endorsed by many foresters as "about right." Later, it was found that the first residual stand was defined by a density of 20.6 percent of height of average dominants. It was decided to follow this line for the next several thinnings, to learn its effect on levels of growing stock. Timing of thinnings is governed by each 7 to 8 feet of added height. This rule, and the curve passing through the points for residual stands, are the controls defining stand density for the plot to the age of 100 years.

Good height growth brought this 6 by 6-foot plantation of 2-year seedlings to a density requiring a commercial thinning within 30 years. The downward curve of

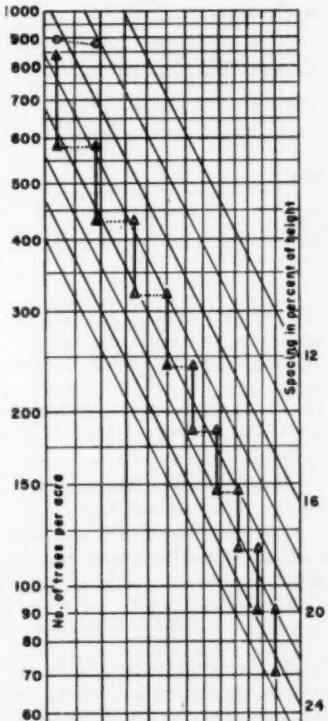

FIG. 1.—Schedule of thinnings at Star Lake. Table 1 gives data for the first two cuts. The check plot has reached a spacing of one-seventh of height.

number of trees over height toward maturity represents accretion cutting and is based on similar trends for many yield tables.

Expression of Growing Stock

The long accepted measures of the amount of growing stock per acre have been total basal area and cubic volume. More recently, Lexen (*8*) has provided us with a new yard stick, bole area. An expression using all three factors: number of trees, diameter, and height, should prove best.

Volume, in cords or board feet, measures the harvest or the amount of forest capital. Total cubic volume is the best measure of site productivity or of response to thinning. Its proportion of heartwood increases with age. This heartwood is an accumulated reserve of forest capital which will eventually be liquidated, but it is not living, growing tissue.

Total bole area, like volume, uses all three factors but expresses suface instead of contents. As a measure of the amount of growing stock per acre, it is perfectly sound from the standpoint of plant physiology. We may well consider how many square feet of stem cambium an acre should be required to nourish. Only this living sheath of cambium produces merchantable wood and is the true growing stock with which foresters are concerned.

Lexen proposes computation of bole area by summation of the values for each tree, but that involves much work and precludes determination of this value from summarized data. In even-aged, managed stands negligible error

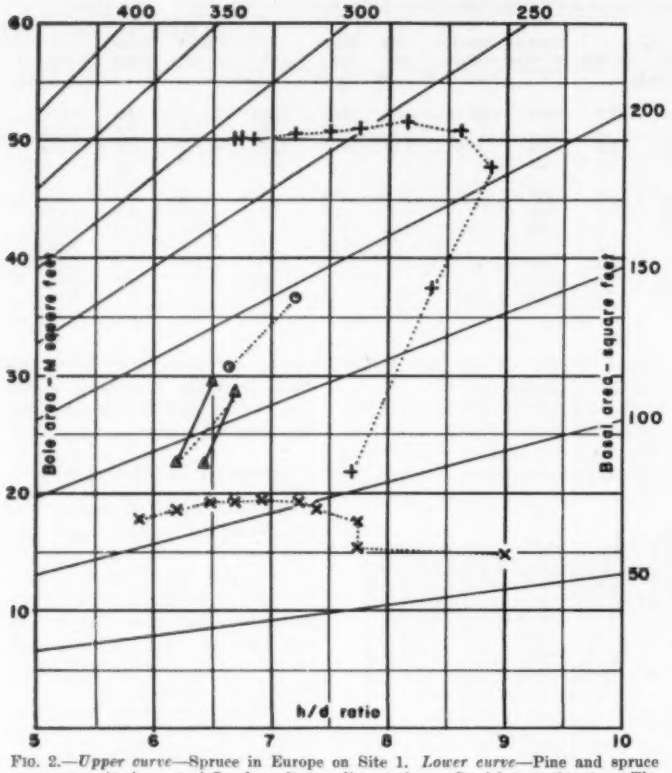

FIG. 2.—*Upper curve*—Spruce in Europe on Site 1. *Lower curve*—Pine and spruce on average site in central Sweden after medium to heavy Danish-type thinning. The courses of the two plots at Star Lake are also shown.

would result if bole area were based on the average tree. This would permit use of a simplified modification of his formula:

$$\text{Total bole area} = \frac{\cdot dh}{7}(n)$$

where d is the diameter in inches and h the height in feet of the average tree, and n is the number of trees per acre. While Lexen reports factors ranging from 7.2 for immature trees to 6.6 for mature trees, he offers 7 as an average value for all classes. The use of this 7 factor tends to compensate for thicker bark on older trees.

Basal area uses only two factors, number of trees and diameter, and is thus related to spacing rules based on diameter. Apparently basal area has earned its standing because of its suitability for all-aged stands, where average diameter, height, volume, and number of trees remain relatively constant. But this discussion deals with even-aged stands, where diameter, height, and volume are increasing, while the number of trees is decreasing.

Relationship of Basal Area and Bole Area

Where the factor is 7, bole area can be derived from basal area by the formula:

$$BoA = BA - 26.19\frac{h}{d}$$

again with d the diameter in inches and h the height in feet of the average tree. This formula is plotted in Figure 2. Acceptance of bole area as the true measure of growing stock for even-aged stands of conifers implies that basal area must be evaluated in terms of the height-diameter ratio.

After trials of many yield tables, it was concluded that the graph for spruce on site I in Europe (*5*), approximates a normal curve, bearing in mind that here normal full stocking has been maintained by periodic thinnings to eliminate suppressed trees. One can readily visualize what happens in the case of shortleaf pine (*6*). Bole area culminates with basal area and then slides down the line for a constant basal area.

Levels of Bole Area

Scotch pine on site I in Europe (not shown) stabilizes around 35,000 square feet of bole area. The range of bole area for the thinned plot at Star Lake cannot be far from optimum for good growth. During the 5-year interval between thinnings it produced 5.5 percent more total cubic volume than the check plot. In other words, maximum increment is secured at optimum rather than at maximum levels of growing stock. The assumption that increment is directly proportional to normal full stocking as given in yield tables, especially for natural stands, is of doubtful validity. In managed stands there may be a correlation between stand density and bole area. Both thinnings at Star Lake, to a density of 20.6 percent in terms of height, left 22,400 square feet of bole area. The gradual decline of the other two curves on Figure 2, though not so directly correlated with stand density percent, does follow the trend of increased spacing in percent of height characterizing mature stands.

Lessons from Star Lake

For the 5-year intervals between the two thinnings, the following observations may be made:

1. Diameter growth for the average tree was only 0.5 as compared with 0.4 inch for the check plot. It might appear that such negligible difference indicates too light a thinning to bring response. Actually, diameter growth has temporarily slowed down. The stand having closed, these tapering plantation trees are now correcting their form for height, as attested by wide growth rings higher up on

the trees. Both plots added 22 square feet of basal area, but the thinned plot produced 5.5 percent more total cubic volume.

2. In merchantable cubic volume increment, the two plots were practically equal. Here the check plot caught up by more ingrowth into the 4-inch class. Yet it produced 9.5 cords of pulpwood compared with 9.0 cords for the thinned plot, because fewer cubic feet of smaller diameter wood are required per cord.

3. The thinned plot showed an increment of 666 board feet per acre per year as compared with 478 for the check plot. Not only did the trees 7.0 inches and over average larger in diameter, but there were more of them, partly due to more ingrowth into this class on the thinned plot.

4. Comparing the residual stands, the second thinning left a lower basal area because of its trend toward the right in Figure 2. When form is fully corrected for height and the prescribed density, this trend should be arrested. Eventually the trend should be reversed and, assuming that residual bole area remains relatively constant, basal area must rise.

In conclusion, this prediction is ventured to illustrate use of the data and factors which have been analyzed. After the thinning at 100 years, with height of 100 feet, and a spacing of 25 percent of height, 70 trees will be left. Bole area for this residual stand will be 20,000 square feet, and the average stand diameter, therefore, 20 inches. The height-diameter ratio will be 5. From the formula $BA = BoA - \frac{d}{h}.0382$, the basal area is found to be 153 square feet.

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Chemical Control of Inferior Species in the Management of Loblolly Pine[1]

L. E. Chaiken

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THE FORESTER'S JOB, if he is concerned with producing tree crops, is to grow the largest volume of the most valuable species. Thus, in practically every timber region in the United States, foresters encounter the problem of limiting the growth of less valued species which inhibit high production of the preferred species. Often these less desired species are utterly worthless and are referred to simply as "brush." For example, laurel and rhododendron slicks cover vast areas in the Southern Appalachians that could produce valued tree crops. Yaupon in East Texas, hazel brush and alder in the Lake States, and manzanita and bear clover in California are other examples of brush that reduce yields and often entirely exclude the valuable tree species.

Brush is not the only problem. Conifers such as pitch pine and shortleaf pine are favored over such hardwoods as black oak, white oak, and chestnut oak on the sandier soils of New Jersey and Pennsylvania. These oaks are classed as desirable in the Southern Appalachians and other oaks are discriminated against. In some regions certain conifers are favored over other conifers, such as western white pine over western hemlock and grand fir in Idaho. Weeds in the forest are notoriously as aggressive and as hard to control as those in the garden. In some areas weed species have taken over huge acreages of forest land.

In the loblolly pine region of the Carolinas, the problem of aggressive hardwood weed species is particularly acute. During the past two decades there has been a steady building up of dense undergrowths, mainly of inferior oaks and gums with local associations of southern waxmyrtle, gallberry, and hickories. Their growth rate is accelerated when released by the removal of the pine overstory, and competition with the pine reproduction becomes quite severe. On many sites there is a very definite type conversion—from pure pine to pine-hardwood mixtures, and eventually, perhaps to almost pure hardwoods. A recent forest survey of South Carolina shows that the upland hardwood type, which in 1936 occupied 0.7 million acres, totaled 1.4 million acres in 1947—an increase of 100 percent in less than 12 years.

This problem is not being ignored. A rather surprising number of individuals and agencies are working on it, and there are almost as many solutions as there are investigators.

The inferior species *can* be controlled—by prescribed fire, by mechanical methods, by chemicals, and by an assortment of such manual methods as weeding, girdling, and felling. While each technique has certain advantages, none is universally applicable to all forest conditions, to all sites, and to all systems of management.

Of all these techniques, chemical

[1]Paper presented at a meeting of the Division of Silviculture, Society of American Foresters, Washington, D. C. December 13, 1950.

control has captured the fancy of many forest managers. So far we have no truly selective silvicide—one that will kill our oaks and gums without injury to the pines. Nor do we have a single chemical that is equally toxic to all species. We have no single technique that is applicable to all conditions. But we *do* have some useful chemicals and techniques.

Investigations in the use of chemicals for the control of inferior species in the flatwoods of North and South Carolina show that there are two major problems: first, to find the best chemical to do the job, and second, to find the best way to get it into the tree. Three chemicals have a real place in the control of woody species: 2,4-D, 2,4,5-T and ammonium sulfamate (commonly called by the trade name "Ammate"). A fourth, sodium arsenite, is probably the most effective silvicide that we have, but unfortunately its high toxicity to man and beast precludes its widespread use. Several other chemicals are available for minor and special uses.

Although there are only three principal chemicals, we have a variety of formulations to choose from. There are the various metallic and amine salts and the esters of 2,4-D and 2,4,5-T, and these may be carried in either water or petroleum oil. Furthermore, it is reported that they can be made more effective by the addition of other chemicals.

We have applied these chemicals to the brush in just about every imaginable way: to succulent foliage and to mature foliage; to skinned bark and to normal bark; to notches, frills, holes, girdles, stumps, and incisions; to tiny sprouts and to trees 46 inches d.b.h.; in low concentrations and in high concentrations (and many in between); in light doses and in heavy doses; spring, summer, fall, and winter; and to a dozen tree and shrub species.

Final results of all these tests are not yet available, but we have a number of observations; we can offer a few conclusions, and make a few predictions.

Foliage Sprays

With foliage sprays, it is first necessary to reduce trees and brush down to the ground by the use of fire or other means, and spray 1- or 2-year-old sprouts. Any small pine trees among the brush have a poor chance of surviving, for either the fire or the chemical spray will kill them. Thus, foliage sprays are restricted to even-aged management.

In our early work with foliage sprays we used the cheapest chemicals available—the aqueous solutions of the metallic salts and amine forms of 2,4-D. Only during a short period of the summer—about the time of the formation of the terminal bud—were they reasonably effective in killing the root stocks of our local species. The sodium salt and the amines were even less effective than the ammonium salt.

We had much better success with emulsions of the esters of 2,4-D and still better control with 2,4,5-T—at any time during the growing season, except during the early spring. All our species are susceptible, but we do have resprouting from some of the oaks.

Our best foliage spray to date, is a 0.25-percent emulsion of 2,4,5-T ester (acid equivalent by weight); that is, 2500 parts per million. At present prices 2,4,5-T costs about $3 a pound, so that a 0.25-percent emulsion costs roughly 6 cents a gallon. Depending upon the amount of brush to be treated, from 60 to 100 gallons an acre are needed. Thus, the chemical cost may range from $3 to $6 an acre. To this must be added the cost of the prescribed burn and the cost of spraying. The entire operation could well cost from $7 to $10 an acre.

It is hard to tell whether this type of treatment is worth-while on a large scale. It requires fairly heavy equipment and a large supply of water. It requires a preparatory fire, or, if the trees are several inches in diameter, some sort of brushing or mechanical destruction. Our present opinion is that foliage sprays will have only limited use in the silviculture of our region. Perhaps their best use will be in the maintenance of rights-of-way.

Cut Surfaces

Another way to apply chemicals is to introduce them into the stems through some sort of cut, such as notches, frills, or stumps. Since this is a selective method—individual trees are treated—it can be done without injury to surrounding pine reproduction.

Most forest managers are familiar with the excellent work of Peevy and others in the use of "Ammate" crystals in notches or cups. This is quite effective and useful in eliminating large trees. Peevy estimates the chemical cost at about 3 cents per 10-inch tree.

Small trees—below 3 or 4 inches d.b.h.—may be cut down and "Ammate" crystals placed on the top of the stump. Instead of using "Ammate" we might spray the top and sides of the stump with 3 percent 2,4,5-T in a kerosene or diesel oil carrier. We have had practically no resprouting of any local species from sprayed stumps. Even lower concentrations, down to 1 percent will give fair control for some species. The chemical cost, using "Ammate," is about ½ to 1 cent per small stump. Spraying with 2,4,5-T costs about ¼ to ½ cent per stump of 3- or 4-inch trees.

"Ammate" in water solution or 2,4,5-T as an emulsion gives excellent control for most species when poured into single-hack girdles or frills. This method is cheaper than notching, for a little chemical does a lot of work. It is even cheaper than stump spraying because water can be used as a carrier instead of the more costly kerosene. Using a 1-percent 2,4,5-T emulsion, the chemical cost of frill applications is from ½ to 1 cent per 10-inch tree. We have had excellent results, for some species, with even lower concentrations of 2,4,5-T—as low as 0.5 percent, acid equivalent, in frills—with correspondingly lower costs. To find a low-cost, all-purpose, all-species tree killer, we are presently testing

mixtures of 2,4,5-T with "Amate" in low concentrations.

Holes, blazes, incisions, and other cut surfaces have been tried, but we have not pursued any of these far enough for this report. It seems reasonable that any method would work that introduces a sufficient quantity of the toxic material into the conducting tissues of the tree.

The question is often raised as to the necessity of poisoning large trees; perhaps simple girdling is all that is needed. If there is no urgency for the immediate kill of the crowns of the offending trees, and if sprouting is not objectionable, why poison? Some of the cut surface methods, however, particularly those that use a minimum of chemicals, are actually cheaper than girdling. If they do a better job of killing the tree and also reduce or prevent resprouting, why not poison?

Basal Sprays

Still another way to get a chemical into the tree—a way that promises to be even cheaper than the others—is to spray it on the bark. This method offers real savings in labor costs. However, it is necessary to strike a neat balance with the chemical, for high concentrations or excessive dosages could well run into prohibitive costs.

Basal sprays (variously called bark, stem, trunk, or dormant sprays) consist simply of spraying a band of bark at the base of the tree. Our studies of this method are not yet complete, but an effective treatment seems to be 2 or 3 percent 2,4,5-T in oil, on a 2-foot wide band circling the tree. Research is under way to test the use of water carriers with added oil penetrants; this could further reduce the cost of treatment.

Trees that are basal-sprayed during the dormant season (when it is easy to do) usually leaf out in the spring. Some species, such as ironwood, myrtle, and gallberry die soon thereafter; others, such as sweetgum and hickory, die slowly. Spraying may be done at any time of the year.

Even though large trees—20 to 30 inches in diameter—can be killed, it is our guess that basal sprays can best be used in the control of small stems, perhaps up to 4 inches d.b.h. In our problem areas, we have thousands of these per acre—too large for prescribed fire, too many for efficient notching or frilling, and where pine reproduction is intermingled, too risky for any other non-selective treatment. Under these conditions, the pine can be released by spraying the basal portion of the inferior competitors. Our studies in chemical weeding show that this costs no more than standard machete weeding, and will be more permanent.

What is the place of chemical control? We are aware that the situation changes as cheaper and more effective chemicals and techniques are developed. At present it does not offer a complete solution to the problem of inferior species in the Carolinas. But, neither does any other method. So, we recognize the merits of chemical control and include it in our methods along with prescribed fire, mechanical devices, and the manual tools.

The Establishment and Development of the Yellow Springs, Ohio, School Forest[1]

The Glen Helen Endowment gave Antioch College a thousand acre tract of land to be developed as a demonstration area for new ideas in wise land use, and a fellowship was awarded to establish a model school forest. One hundred acres were set aside and a management plan was made for the students' use. It included a planting plan, thinnings of the existing pine and spruce stands, management of the other tree areas, a fish pond, a parking space, campfire site, a nature museum, a cabin site, fire lanes, and a system of roads and trails.

A Christmas-tree cutting festival was held to help thin the pine and spruce stands, publicize the new project, and obtain money. Families cut their own trees with the assistance of high school students, and local groups assisted in presenting an outdoor Christmas program. Under the management plan there will be annual Christmas-tree cutting festivals.

An agreement was made between Antioch College and the local high school whereby the high school students would manage the land with the assistance of an advisory board. In the spring the first annual planting was made, when 3,000 pine seedlings were planted, and the land was recognized as the first Class A School Forest in Ohio.

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[1]Abstract of Master of Forestry Thesis, University of Michigan, 1950.

From Field to Forest—A 50 Year Record[1]

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FIFTY YEARS is a short time in the life of a forest but a long time in the life of a forester! Foresters' practices have changed much since Indiana's Clark State Forest was nothing but an idea.

Forestry practices should be based on a careful analysis of our experience. Then we should proceed on a basis of the best evidence we have available. So, in presenting this account of the man-directed Clark State Forest, the best tree evidence available will be used. The record for this forest property has its counterpart in other places and consequently it represents a cross section of what has taken place in many hardwood forest areas of eastern United States.

The period 1800 to 1860 was the era of active settlement in Indiana. This was followed by the period 1870-1900 when cities were built, railroads were constructed and, farm machinery was introduced. Consequently, the forests were cleared for agricultural use and no thought was given to the future supply of timber. It is therefore rather interesting to note that following the Civil War a few progressive citizens began to be concerned about the destruction of Indiana's forests. A few pioneer thinkers even suggested tree planting, and in a few places the reforestation of abandoned or cutover lands were started as early as 1880. Public sentiment toward forest preservation and tree planting finally took form on March 1, 1901 when the Indiana Legislature established a State Board of Forestry.

In 1903, the State Board of Forestry was empowered to buy 2,000 acres of land in any county or counties of the state for a forest reservation, laboratory of forest demonstration, and state nurseries at $8 or less per acre. The board, after considering 30 offers, decided to buy the tract offered by Dunlevy and Freeman of Henryville. The tract is located in the northwestern part of Clark County and consisted of about 20 old farms. The price paid varied from 21 cents to $38.79 *per acre*. It is part of the 150,000 acres given to General George Rogers Clark and his men by the State of Virginia for their part in capturing Vincennes from the British. This forest reserve now consisting of about 17,000 acres, is now called the Clark State Forest.

In 1903 the objectives for the forest reservation were to cultivate the timber, to plant seeds and seedlings in the cleared portions, and to experiment in general forest cultivation.

Descriptions of the area are found in the annual reports of the State Board of Forestry; the first account of the "forest reserve" was included in the 1903 report. Since there were errors in the early records, the description given is adapted from the early records with corrections and information supplied by C. C. Deam.[2]

In 1903, about 600 acres of the northwest part of the reservation was in the "knobs" region. It was covered principally with chestnut oak (*Quercus prinus*) and Virginia pine (*Pinus virginiana*). The remainder of the woodland area was about 300 feet lower than the knobs and was commonly called black and white oak land. The principal species were white oak (*Quercus alba*), chestnut oak (*Quercus prinus*), scarlet oak (*Quercus coccinia*) and black oak (*Quercus velutina*). Chestnut (*Castanea dentata*) occurred locally in groups or as an occasional tree in the mixed hardwood stands. On some parts of the area post oak (*Quercus stellata*) was commonly found. On areas from which most of the timber had been removed and permitted to regenerate, black hickory (*Carya glabra*) was the dominant species. Along the ravines are found birch (*Betula nigra*), elm (*Ulmus* sp.), sycamore (*Platanus occidentalis*) and sweet gum (*Liquidamber styraciflua*). Tulip poplar (*Liriodendron tulipfera*), beech (*Fagus grandifolia*), ash (*Fraxinus* sp.) and hard maple (*Acer saccharum*) are rare, being noted only on the lower slopes. Several hundred acres in the north central part were burned over in 1901 and had grown up to be an impenetrable wilderness by 1909.

The early accounts of stand conditions on the area at the time of its purchase show that fire was a major factor in keeping the cutover stands poorly stocked. Some of the early entomological reports of the reservation show that fire scars and insect damage were very common, and that few trees appeared sound and of good form. References were also made to the fact that unrestricted cutting caused by the dependence of the people on timber to produce their incomes, took every tree that would produce a railroad tie.

Although the estimates of the number of acres of cleared land vary from 300 to 600 acres, it appears that there were about 300 acres of old fields that were artificially reforested during the years 1903-1923. In 1909 a survey was made. All old fields were mapped and given a tract designation number. In most cases a record of each tract has been kept since 1909, giving the tree planting history.

During the early years (1903-1926) the forest reserve was the experimental forest of the state. There all kinds of forestry experiments were conducted. The real experimental work began in 1909 when C. C. Deam became state forester. He started a systematic study of woods practices and reforestation problems. He made a thorough study of the area, mapping and describing the forest cover types.

[1]Journal Paper No. 504 of the Purdue University Agricultural Experiment Station, presented at a meeting of the Division of Silviculture, Society of American Foresters, Washington, D. C., December 15, 1950.

[2]From C. C. Deam who made a very intensive study of the area in 1909.

The cultural practices carried out on the forest were based largely on European experience and the influence of the early foresters who visited the Clark Forest. The agricultural interests, and those concerned with farmstead windbreak, fence posts, hedge fence, and other types of tree planting, influenced the reforestation experiments carried out by Deam. All these influences were important in shaping the practices that were followed. Also, protection of the area from fire and livestock grazing, plus the factor of time, have all contributed a part to the record of tree growth as it can now be seen or reconstructed from the past and present records.

The silvicultural experiments on the forest were divided into two parts: (a) Woodland experiments and (b) Tree planting or reforestation.

Of the two phases, tree planting appears to occupy the more important part of the experimental work. However, it was observed early that because of the silvicultural condition of the woodlands, protection from fire and livestock grazing and time were essential in building up the growing stock. The early inventories that were made indicated clearly that the young stands needed time to grow to merchantable size.

Woodland Experiments

The woodland area had been cut over prior to its acquisition by the state in 1903. Even after the area was acquired a great amount of cutting was done which was described in the early reports as forest cleaning. During the years 1904 to 1909 about 1 000 acres were given a forest cleaning which meant that all inferior and excess trees of every kind were cut out and converted into dimension material, lumber, railroad ties, or fuelwood. Deam's[3] unpublished report on these early operation indicated that much of the cutting was not carried out for the good of the woods but for income producing purposes. Then too, some cutting to provide timber for construction purposes, together with the forest cleanings, left most of the wooded area with very few merchantable trees. In the light of what has taken place in these stands during the past 40 years, it appears that the forest cleanings benefited the stands. The removal of all the fire scarred and defective as well as sound trees was virtually a clear cutting. The stands that grew up following the forest cleaning operations are even-aged, with the principal species being white oak, black oak, and hickory. On parts of the area the composition of the stand is chestnut oak, black oak, and hickory.

Stand tables published in 1906 (*3*) and checked by Deam (*1*) in 1910 show that the stands consisted largely of mixed hardwoods of sprout origin. Of a total of 676 stems per acre, 2 inches or larger in d.b.h., there were only 24 trees that were over 10 inches d.b.h. Chestnut oak, black oak, white oak, and hickory were the principal species. One of the sample acres showed that of a total of 1,312 stems, over half were chestnut oak, with only 28 stems 10 inches or more in d.b.h. Another sample acre gave a total of 826 trees of which 44 were Virginia pine. There were only 17 trees that were 10 inches or larger in diameter, and none that exceeded 12 inches. These figures all clearly indicate that building up the growing stock both in size and quality was highly necessary. They also show that the woodland area in 1910 consisted of cutover land restocking to mixed hardwoods, largely of sprout origin, together with hardwoods and some Virginia pine in mixture in the knobs part of the area.

Field measurements taken about 20 years later (1929) show that the mixed hardwood stands developed under protection from fire and livestock grazing. There was little change in composition except on a few areas where chestnut was killed out by the blight. On these areas the oaks have replaced the chestnut.

During the years 1933-1941 the Civilian Conservation Corps program included the cutting of dead chestnut and stand improvement cutting which removed defective material for fuelwood and charcoal use. Some larger trees were also cut and used for building and construction purposes. Lakes were built which required the clear cutting of some areas. No detailed records were kept of the volume removed in these cutting operations. Therefore it is impossible to state just how much material was cut from the woodland area which constituted the original purchase.

The cutting that has been done in these hardwood stands has apparently favored the establishment of Virginia pine. It has gradually spread from the knobs part of the area to the lower slopes and is now found in mixture with hardwoods throughout the entire forest. A timber cruise covering a portion of the area was made in 1929. At that time Virginia pine was a common associate of the mixed hardwoods. The total number of trees over 4 inches d.b.h., in 1929, varied from 80 to 250 per acre. Virginia pine 4 to 16 inches d.b.h., numbered from 8 to 50 stems per acre.

Seventeen years later—in 1946—a cruise of this same area showed Virginia pine still present with about the same number of stems per acre. On some portions of the area pine trees over 14 inches in diameter had been cut prior to 1946. If these cut trees are added to the number present in 1946, the percentage of pine shows a slight increase during the 17-year period. Not only has the Virginia pine come into the hardwood stands but it also invades the old fields and many of the reforested old fields. (Fig. 1.)

Frequent field checks on stand conditions and growth trends during the past 20 years show that the composition of the stands has not undergone any marked changes. The mixed hardwood stands still lack adequate growing stock. Their annual volume increment varies from poorly stocked stands which are producing only 42 board feet per acre to the better stocked stands where growth is 220 board feet per acre.

Experimental improvement cut-

[3]From personal conversation with Deam.

FIG. 1.—Virginia pine, 35 years old, which seeded in naturally on an old field. Hardwoods have come in under the pines and will eventually succeed them.

tings designed to remove low quality trees and to favor the best formed and highest quality trees have been tried in some of the stands. These cuttings left the stands with a good diameter class distribution, spacing, and basal area, but over half the annual volume growth is being placed on chestnut oak, one of the least desirable species.

The silvicultural problem in these hardwood stands is one of increasing the percentage of desirable species and building up the volume and the quality of the growing stock. Many of the stands were still too poorly stocked to warrant much cutting other than improvement cuttings.

Reforestation Experiments

That tree planting was considered to be an important phase of the forestry work done on the reservation is well illustrated in the early records. Tree planting began in the fall of 1903 when about 110 acres of old fields were directly seeded with various species of hardwoods. The hardwoods used included black walnut, oaks, and hickories, which were seeded in mixtures and in pure stands. About 15 acres were thickly sown to hardwoods in order to have seedlings for field planting. The results of these seedings were encouraging, but the rodents worked havoc in all the fields bordered by woodlands, especially the parts next to the woodlands.

The records show that each fall and spring during the years 1903 to 1908 (*4*) direct seeding of hardwoods and planting of hardwood seedlings was done on the old fields. Deam's (*1*) summary in 1910 showed that between the years 1903 and 1910, 28 old fields consisting of about 110 acres were seeded or planted. Nineteen different hardwoods were used, and mixtures of species were planted or seeded. The spacing used in most cases was 5 by 5 feet, a few being 4 by 4 feet and one 16 by 16 feet; and on two areas mixed hardwood seed was sown broadcast. The old fields were plowed and disked prior to tree planting or seeding.

Each season most of the plantations were cultivated. The cultivation meant a plowing, and when the trees were young and in rows 5 feet apart it was thought necessary to plow between the rows three times. When the trees were 4 or 5 years old it was thought necessary to plow very shallow once or twice between the rows. Hoeing of some of the plantations was also a practice, and it meant the cutting down of all weeds, grass, shoots, sprouts, briers, etc., left by the plow. Growing crops such as corn between the rows of trees was also a common practice. It is evident from the records that these early seeded and planted hardwoods were given very careful management. As the trees developed, cultural measures included pruning, thinning, and coppicing. Replanting of the failed places was also done for one or more years following the initial seeding or planting.

That some of these early reforestation experiments were initially successful is indicated in the annual report for 1910 (*1*). The initial establishment and growth of black walnut, tulip poplar, black locust, chestnut, and catalpa were satisfactory. The results with other hardwoods like elm, Kentucky coffee tree, and the oaks were not as encouraging, but the results appeared to be indicative and not demonstrative. One of the species which showed considerable promise was white ash. The 1910 report (*1*) states "present results indicate that white ash is one of the most desirable forest trees to plant in Indiana." This statement was based on the results on 9 acres of ash plantings that were either directly seeded or planted on three different fields.

Hardwoods continued to be used for tree planting and a few species like sycamore, tulip poplar, ash, and black cherry continued to show fair development. As the yearly records of the direct seeded and planted areas began to accumulate, it became apparent that too many of the hardwoods stagnated or died.

In 1923 Deam published a summary (*2*) of the reforestation experiment for 80 different tracts. Many of the hardwood direct seedings and plantings had failed to develop into good young stands, and many of the experimental tracts were "underplanted to white pine in the spring of 1920."

The change from the use of hardwoods to conifers was probably due to the influence of some tree planters in the Central Hardwood region who reported better results when conifers were used in old field planting. The failure of the hardwoods, the good initial survival and early growth of a few of the older coniferous plantings, and the availability of coniferous planting stock all contributed to the general use of conifers. Although conifers were not used generally for field planting on the Clark Forest until about 1920, a few plantings were made prior to that time.

The first planting was made in the spring of 1904 when 10,000 small white pine seedlings, secured from Sturgeon Bay, Wisconsin, were transplanted on the knobland area. The summer drought caused the death of all the planted trees. Another planting of white pine was made in 1912 when 12,000 three-year transplants, obtained

from Au Sable, Mich., were planted on an old field. Mortality was very high, and the area was replanted in 1913. In 1915 only 10 percent of the trees planted in 1912 and 1913 had become established. These early results were not very encouraging but the trees that did survive made good growth. Consequently, in 1920, some of the old fields that had been seeded or planted to hardwoods, but which had failed to develop were underplanted to white pine (*Pinus strobus*).

About the same time an experimental planting was started of each of the following species: Scotch pine (*Pinus sylvestris*), red pine (*Pinus resinosa*), jack pine (*Pinus banksiana*), pitch pine (*Pinus rigida*), Norway spruce (*Picea abies*), European larch (*Larix decidua*), Douglas-fir (*Pseudotsuga taxifolia*) and Virginia pine (*Pinus virginiana*).

The initial survival of the planted conifers, excepting Douglas-fir, Virginia pine, and larch, varied from 60 to 90 percent. The initial height growth was satisfactory; so as new plantings were made, conifers were used and hardwoods, excepting black locust, were seldom planted.

One of the conifers which gave early promise of being suitable for reforestation was Scotch pine. It was first used on an old field which had been seeded to white oak in 1911-12 but which failed to grow. In 1920, Scotch pine seedlings were planted and replanted in 1921-22-23. Spacings from 4 by 4 feet up to 8 by 8 feet were used. Survival of the trees was 85 percent, and by 1929 a well stocked stand had developed; the average diameter of the trees was 2 inches, their height 14 feet. The closely spaced pine made slightly less diameter growth for a few years than did the wider spaced trees. However, the dying of the lower branches, the natural death of some of the trees, and the accompanying hardwood succession soon caused the Scotch pine to thin out. The stand continued to thin out, and in 1940 began to deteriorate very rapidly. The 30-year old stand is now less than 30 percent stocked and the area is now reverting to hardwoods. Scotch pine is losing out in competition with the hardwoods, and although this was one of the best Scotch pine stands in 1935, it is now a failure. This species is not adapted for reforestation purposes even though early growth would indicate otherwise.

The other conifers that were used to reforest the old fields show varying degrees of development. Pitch pine, because of its poor form, is not generally suited for reforestation. Jack pine has shown good initial establishment and growth, but its latter development does not warrant its general use for reforestation. The 30-year old red pine was planted on a very poor site. Its development is not at all indicative of the usual results obtained when it is planted on an old field. Norway spruce gave early indications of being a suitable species for reforestation, but a few drought years soon eliminated nearly all the planted trees. The same experience was encountered when European larch was planted on the old fields.

Case Histories

To show what has taken place on the old fields which were direct seeded or planted to hardwoods, case histories are presented of areas representative of the reforestation experiments. These selected tracts also represent the longest period of time, and they illustrate the forest successional trends on the old fields.

White ash was planted on several areas and Tract 1 illustrates one of the oldest plantings. White ash seed was drilled thickly in rows in the fall of 1904. Good germination and survival resulted and in the fall of 1906 it was thinned, leaving the stand with trees on approximately a 4- by 4-foot spacing. The trees were cultivated for several years and in 1910 the trees were pruned. In 1915 measurements of the ash were as follows:

	D.b.h.
	Inches
Trees unpruned	1.2
Tree moderately pruned	1.1
Trees severely pruned	1.4

Apparently these results lent little encouragement to future management since the plantation was left to develop without further cultural treatment. In 1950 nearly half of the original stand is still present. Growth of the ash has been very poor. The 46-year-old trees are only 3 to 6 inches d.b.h., with a few trees attaining a diameter of 8 inches. Failure of the ash to attain larger size is probably caused by the poor site and because it does not occur or grow naturally in pure stands.

FIG. 2.—*Tract 61*—Sycamore Plantation. The 37-year-old trees are 3 to 6 inches in diameter. Naturally seeded sweet gum, white ash, tulip poplar, and Virginia pine have come into the area. Marked trees indicate the best development of the planted sycamore.

Tract 61 is a sycamore plantation consisting of about 4 acres. Seedlings were planted in April 1913 and good establishment resulted. The trees were spaced 4 by 4 and 5 by 5 feet, part of them being cultivated for 2 years and the others receiving no cultivation. For a few years the cultivated trees grew better than the uncultivated trees. This was a temporary condition. As the plantation continued to develop without cultivation, differences in the two plots were not noticeable. After 37 years, half of the planted trees are still present. They are now from 3 to 6 inches in

diameter. Many of the trees are partly dead and will probably die completely during the next few years. Natural succession of sweet gum, tulip poplar, ash, and Virginia pine has taken place, and some of these trees are larger than the planted sycamore. Natural seeding of Japanese red pine from planted trees is also found on a portion of the area. Failure of the sycamore to show better development is not due to site but because pure stands of sycamore are unnatural (Fig. 2).

An experiment to determine the relative rate of growth and shade tolerance of several hardwoods is found on Tract 74. In May 1913 seedlings of ash, chestnut oak, basswood, black locust, catalpa, elm, sycamore, and tulip poplar were planted. The plan was to grow one row of each species between two rows of each of the other species. In 1914 replanting was done in order to have a complete stand. The area was plowed and disked prior to planting and the trees were cultivated for 2 years. The chestnut oak failed to grow and the survival of the other species ranged from 65 to 90 percent. Height growth for a few years after establishment varied from the black locust, which grew most rapidly, to basswood which made the poorest height growth.

In 1923 sugar maple seedlings were underplanted in the center of the space between each four trees. The initial survival of the maple was about 90 percent.

The plantation was first thinned in 1937 when a few black locust, which had grown to post size, and some poorly formed tulip poplar and sugar maple were cut. No other treatment has been attempted, and in 1950 the stand is composed largely of sugar maple. Seventy-five percent of the 27-year-old sugar maple are still present, and they vary from 2 to 7 inches in diameter. About 10 percent of the tulip poplar are present, and they are from 5 to 17 inches d.b.h. The other species that were planted are represented by only a few scattered trees, all 5 inches or less in diameter.

The stand is still very dense and forest floor conditions are typical of a closed hardwood stand, with a good cover of hardwood leaves and litter. A few sassafras, black cherry, and Virginia pine have come into small openings, but the dense canopy of the sugar maple has kept out most of the invading hardwoods. Although the growth and development of sugar maple when underplanted or interplanted with other hardwoods is not satisfactory, the experiment does illustrate its extreme tolerance as well as its persistency (Fig. 3).

FIG. 3.—*Tract 74*—Mixed hardwood plantation which was interplanted with sugar maple in 1923. The 27-year-old maple now forms a dense closed stand. Trees numbered 9 and 11 are 5 inches d.b.h. Tree number 10 is 6 inches d.b.h. Most of the other planted hardwoods have died.

The growth and development of the tulip poplar in this mixed stand is near that exhibited when it grows naturally in the hardwood forest. It tends to be very intolerant and consequently only a few trees survive the competition. Tulip poplar occurs naturally as an occasional tree or group of trees in mixture with other hardwoods (Fig. 4).

The three cases illustrate what has been the trend when hardwoods were used to reforest old fields. They show that, given enough time to develop, some of the planted hardwoods will grow to merchantable size and eventually form part of the mixed hardwood forest. It is also evident that hardwoods do not grow well in pure stands when planted or seeded in an old field. Apparently hardwoods are trees of the woods which grow best in mixed stands, in competition with other species and on forest soils. *Old field soil and site conditions appear to be unfavorable for the hardwoods.*

Three examples of the early hardwood plantings, later planted to white pine, are indicative of similar results which were encountered on many of the old fields. Tract 37 was direct seeded to hickory in 1904-1905. A fairly good stand resulted, but by 1908 it was thought advisable to plant seedlings of elm and ash. The trees

FIG. 4.—A few tulip poplar, planted 42 years ago on an old field, now form a part of the naturally seeded hardwood stand.

were cultivated for 4 years and the ash was given a moderate pruning in 1911. In 1919 the average d.b.h. of the ash was 1 inch and the elm 0.7 inch d.b.h. In May 1920 the vacancies in the ash were replanted with white ash seedlings. The elms were practically all dead in 1920, so in 1921 white pine was planted where the elm had failed. In 1950 the 30-year-old white pine is from 3 to 13 inches d.b.h. and there are approximately 250 stems per acre. The 45-year-old hickory still persists but most of the trees are less than 6 inches d.b.h. There are a few elm and ash trees, 1 to 3 inches d.b.h., growing on the area.

Similar results were obtained on Tracts 44 and 47. On Tract 44, seed of black walnut and chestnut were planted in the fall of 1906. The chestnut failed to grow, so the vacancies were planted to black locust. In 1921 both the black walnut and the locust had failed to develop, so white pine was planted. On Tract 47 basswood seedlings were planted in 1912. The ground was prepared and corn was grown between the rows of trees. In 1915 black locust was planted between the basswood rows because the locust were considered to be beneficial to the basswood. The basswood grew very slowly and developed a bushy form, so in May 1918 the basswood were coppiced with the hope of getting a vigorous straight shoot. In May 1920 white pine transplants were planted in the center of the 8- by 8-foot space between the basswood. Replanting with white pine was done in 1921-22-23.

The basswood survivors are poorly formed trees less than 6 inches in diameter. It was unfortunate that the basswood used was the European species.

The white pine stands that have been grown on Tracts 44 and 47 are very much alike. In 1950 the maximum diameter of the white pine is 15 inches with approximately 100 stems per acre 8 to 15 inches d.b.h.

Although the white pine have shown good establishment and growth, it was necessary to cut out the competing sassafras, persimmon, Virginia pine, and other species including climbing vines in order to favor the white pine. Thinning and pruning of the white pine have also been done. To grow the white pine to larger size, cultural practices will need to be continued (Fig. 5).

FIG. 5.—*Tract 44*—White pine—climbing vines were cut, plantation thinned, and crop trees pruned in 1937.

Above.—25-year-old white pine—thinned in 1945.

Below.—Photo taken in 1950 or 5 years after the last thinning. Hardwood regeneration consists principally of white ash, tulip poplar, and sweet gum. Annual growth of pine is 400 board feet per acre.

All the examples given show the trend of natural succession on the old fields that were planted to both hardwoods and conifers.

All the old fields used for the reforestation experiments had been farmed, and soon after agricultural use was discontinued, natural succession started on both the planted and unplanted fields. Since most of the areas to be planted were plowed and prepared for planting, and since many of them were cultivated for several years following planting, natural vegetative succession was kept in check. However, as soon as cultivation ceased, natural succession started with a cover of weeds and briers. Early tree invaders of these areas were sassafras, persimmon, Virginia pine, and dogwood. Soon other species such as red maple, black gum, sweet gum, ash, tulip poplar, and elm began to appear. Then followed the hickories, oaks, walnut, basswood, and other hard-

woods. The succession does not always follow in exactly the order given, but the general trend is from the lighter seeded species to the heavier seeded ones. Factors such as seed source, seed dissemination, rodents, and birds enter in and may be the cause of successional changes that do not follow any fixed pattern. Regardless of the composition of the plantation, it is evident that some trees will invade the area and become established. Along with the invasion and establishment of forest tree species other vegetation comes in, such as grapevine, bittersweet, Japanese honeysuckle, woodbine, greenbrier, and poison ivy. They offer severe competition to both the planted and naturally seeded trees.

These successional changes that take place make it necessary for cultural practices to be carried out in order to encourage the growth of the planted trees and those desirable species that come in naturally.

Conclusions

The woodland area experiments show that protection from fire and livestock grazing are essential needs. Improvement cuttings designed to increase the quantity and the quality of desirable species are needed to build up the growing stock and to increase the volume increment.

Old fields are not suitable sites for planting or direct seeding of hardwoods. Hardwoods appear to be very exacting in their site requirements. Old field soils do not have the organic content, the water holding capacity, or the porosity necessary to grow hardwoods.

Nearly 50 years of field to forest experience shows that more time is required to judge the results of a hardwood planting than that of a coniferous planting.

The trend in natural forest succession, which we attempt to speed up or short cut by reforesting an old field, continues to advance and it is not easy to observe or anticipate the changes that take place unless a tree growth record is followed for a long period of time.

After nearly 50 years it becomes evident that as the natural forest succession comes in to make changes in the composition of the stand. some of the planted trees will form part of the final mixed stand.

In direct contrast with the hardwood planting and seeding experiment it has been found possible to grow a pine crop on an old field with proper care and management, and at the same time encourage natural hardwood succession eventually to restock the area.

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Arkansas Timber Stands Before and After Cutting

To learn about timber cutting practices in Arkansas, a survey of logging operations was conducted in 1949-50.

It was found that both pulpwood and sawlog operators take an average of two-thirds of the pine growing stock from stands in which they cut. Pine trees cut for sawlogs in southwest Arkansas average bigger than in the mountain regions, but stands are cut more heavily in the mountains. Large sawmill operators leave a heavier stand after logging and take more of their cut from big trees than do the small mill operators.

Hardwood logging does not cut into stand volume as heavily as pine: volume removed ranges from one-fifth of the growing stock for hewn ties to half for veneer and sawlogs. Higher grade hardwood timber is cut more severely than lower grades. Hardwood timber cut in southwest Arkansas and the Delta is usually bigger than in the mountain regions, although the proportion of stand left after cutting is about the same everywhere. The contrast is less than in pine, but large hardwood sawmill operations also take bigger trees than small mill operations and leave more of the initial stand after logging.

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Forest Roadside Control of Alder and Willow[1]

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FOREST protection men will agree that one of the most difficult problems and most expensive of solution has been the control of woody vegetation on forest protection roads. E. F. Heacox, forester, Weyerhaeuser Timber Company, has stated that the largest cost item in producing a new crop of trees is protection, the largest cost item of protection is road maintenance, and the largest cost item of road maintenance is brush control.

Brush control has been largely accomplished with various hand tools, by protection crews during the summer months. Personal observation and confirmation by others indicates that this requires as much as ten man-days labor per mile of red alder.

Brush mowers developed by the U. S. Forest Service have been used on several tree farms to remove brush at a greater rate of speed with lower labor cost. A consideration, however, is the depreciation of specialized equipment and the necessity for a skilled operator for maximum efficiency. Moreover, continual stump sprouting requires retreatment every year or two until the road has sufficient shade to discourage regrowth.

During the summer of 1948, the Washington Forest Fire Association became interested in the problem of chemical brush control. It was thought that the work of other agencies, such as the right-of-way projects of the City of Seattle Light Department or of the Washington State Highway Department did not typify the problem on forest protection roads. Therefore the objective set was the control of the brush interfering with drainage ditches and that which impeded passage of vehicles. A further objective was the adaptation of the standard fire-fighting tank truck with power take-off pump and a standard forestry fog nozzle to the job without the necessity for purchasing specialized spray equipment. Determination of the proper season of spraying, climatic effects, methods of application, etc., also required study.

As a start, with the help of H. N. Leckenby, a contract spray man and merchandizer of spray chemicals in Seattle, one and one-quarter miles of red alder roadside averaging 5 feet in height was treated during mid August, 1948. A 40 percent sodium salt 2-4-D mixture of Leckenby's so-called "Special Mix" in solution of 400 parts per million of water by weight was used. This mixture comes in powdered form and is very soluble in water, requires no agitators or other special gear, and is noncorrosive.

The spray rig was an International stake-side truck with two-speed axle, equipped with a Pacific Marine Type "Y" pump powered from the transmission and carrying a 500-gallon tank.

A 1-inch Griswold Fog Nozzle, type 4 N A P with 4-foot applicator for part of the strip was selected and a Bean orchard nozzle chosen for the remainder. At 200 pounds pressure, the fog patterns of these two nozzles were at variance. The applicator generated a wide flat pattern which laid a curtain of fog over the foliage with little agitation of the leaves, while the Bean nozzle generated a long cone pattern which agitated the leaves considerably as it blasted through them.

There was no significant difference in results between the two nozzles. Also, the last of the solution from the bare hose end was jettisoned as the last 200 yards of strip were covered. This gave the best kill of the lot. The next spring the area on which nozzles were used showed about 75 percent kill on a strip 3 to 4 feet wide.

Following the first project, during the same month, a strip on a tree farm in Grays Harbor County, was sprayed using the same concentration and the applicator nozzle from a Chevrolet truck with four-speed transmission and an Edwards model 150 pump front-end mounted. Part of this was done on a strip that had been mowed a few weeks earlier. No sprouts were showing above the level of competing brush and grass, but there were some below this level. When this was examined after an elapsed time of 13 months since spraying, the area had been mowed again. There were numerous severed sprouts about 3 feet long at both ends of the test strip; on the test strip there was only an occasional severed sprout. These few sprouts are believed to have occurred because the roadside was sprayed too soon after the original mowing and the sprouts were protected from the spray by the competing vegetation. Further, it was noticeable on this strip that the lateral branches on the background trees were not reaching toward the road as were the unsprayed trees.

The experiments were continued in 1949 using the International tank truck and a 6-foot fog nozzle applicator which proved more satisfactory that the 4-foot length. It was decided to determine, if possible, the optimum season for the treatment, the optimum concentration of solution, and the effect of humidity and temperature on results.

A series of three ½-mile plots were sprayed with different concentrations of solution at intervals of about ten days. The red alder height varied from 1 to 15 feet and was unusually dense in most areas. With the truck in the lowest gear of the low gear range a nozzle pressure of 200 to 250 pounds and movement of 4 to 5 miles per hour was maintained. Mounting the pressure gauge on the dashboard greatly assisted the driver in this respect. Under these conditions 500 gallons of solution were used per 1½ miles of roadside strip, one side of the road.

The first spraying was done April 27, 1949 when the leaves

[1]Paper presented at a meeting of the Western Forestry and Conservation Association, Portland, Ore., December 10, 1949.

were 1 to 1½ inches or less in length. In some cases they had barely burst their buds. By mid-June this day's work was thought a failure, so far as actual killing of red alder was concerned, but the terminal buds reaching to the road were killed and there was no further growth to impede traffic. Willow, which is very susceptible to 2-4-D was killed. This near-negative result of too early spraying was confirmed independently on a tree farm this year.

On spraying conducted from May 10 on, when the alder leaves averaged 2½ inches and more in length, positive results began. Speed of action and positive results receded by mid-July. Variable results were achieved after this date but the optimum period appeared to have passed. This may be altered locally by soil moisture and direction of exposure.

Concentrations used were 250 parts per million, 375 p.p.m. and 500 p.p.m. The 375 p.p.m. concentration was soon dropped as being of relatively slight significance from an experimental point of view, and 1000 p.p.m. was substituted.

On dense stands of red alder the 250 p.p.m. solution caused the leaves to wilt, the terminal growth to become misshapen, and the buds to begin to dry in a week to ten days. By the end of the second week some leaves turned brown, at a month's end most of the leaves were brown but there was a noticeable number of green leaves which persisted to the end of the season. Whether the isolated leaves will grow again next year is debatable, in most cases, probably not, but the branches not affected may grow the following year. On sparse stands of small red alder this solution produced a good kill. The 375 p.p.m. produced a litfle better result than did the weaker solution. The 500 p.p.m. followed a slightly faster time table, and the kill was practically complete to a depth of 3 to 4 feet from the edge of the road. The 1000 p.p.m. solution produced faster results, but the trees once killed appeared the same as those treated with the 500 p.p.m. solution.

A probable reason for the relative effectiveness of the 500 p.p.m. solution on dense stands is that the denser foliage blocks drift of the fog to the interior leaves, but the stronger solution deposits enough chemical on the leaves to do the job.

There seemed to be no correlation between humidity, temperature, and results obtained. Rain within a few hours after spraying did have an adverse effect on the spraying because it washed the chemical from the leaves before penetration or absorption.

In one instance three test strips were sprayed, starting about fifteen minutes after a very heavy drenching shower. The sky immediately cleared and there was no rain the remainder of the day or that night. At this time the upper leaves of the trees had no water standing on them, but were damp. The lower protected leaves had water standing on them. The weaker solution, 250 p.p.m., produced a rapid, even kill. The stronger solutions produced excellent kills to a depth of 3 or 4 feet in the densest red alder growth, despite a slight unfavorable breeze. It is believed that this was caused by the better than usual coverage which was obtained by the diffusion of the chemical through the water standing on the foliage.

Wind can be a distinct disadvantage because of the fog drift caused by a slight breeze. To avoid this in some areas it may be necessary to spray early in the morning or late evening. Some advantage was found in holding the nozzle at the rear of the truck, because the slight breeze caused by the truck passage tended to draw the fog to the road.

Probably the greatest single element in the success of a spraying job is proper coverage of all foliage to be treated. If any parts of the tree are missed or are inadequately covered, they will persist. This does not seem to be in accord with statements that the chemical kills by passing to the roots of the trees, disrupting their functions by erratic stimulation of cell growth. This may be the case in fleshy rooted weeds.

This action does, however, have a place in the practical application. It is possible to prune large red alder along the right-of-way without killing the tree. It is only necessary to spray the overhanging branches to stop further growth and kill them. The best results were obtained in controlling the roadside alder when the tree heights were below 6 or 7 feet.

Since perfect application is not always possible, it may be desirable or necessary in some instances to touch up the job by respraying spots the following year on the denser stands.

This report has dealt with the action of the sodium salt form of 2-4-D in water solution on red alder and willows. It is particularly effective on these species, which constitute by far the largest road maintenance problem of the Douglas-fir region. Of these species, action is much faster and more positive on the willows.

The chemical is not effective on vine maple or various berries. At the concentrations used in this experiment it was ineffective on mountain alder, cottonwood, and elderberry. Action was erratic on bigleaf maple and hazel. It did no damage to softwoods, except in one instance where it caused a slight deformation of leaders of small Douglas-fir.

For a comparison, a strip of red alder and willow was sprayed with a water solution of 500 p.p.m. ester form 2-4-D on the same day that a comparable strip was sprayed with sodium salt solution of the same concentration. At first examination two weeks later, it seemed that the ester form was acting faster. An examination six weeks after spraying showed no significant difference between the condition of the two plots. The relative merits of the two solutions was not tested on the more resistent species. Some manufacturers' agents state that the ester form is superior for woody plant control, but it was not so demonstrated in this single test. More inquiry is needed.

Repeated inquiries have been received regarding cost per mile of treatment. This seems analogous to asking how much it costs to raise a child. A number of variables are involved; among them, the distance to water, time necessary to fill the tank, varied truck operating expenses, etc. In one instance where the water source was in the middle of the spray area it took 65 minutes to fill the tank, add chemical, and spray 1½ miles of strip, one side of the road. The chemical (500 p.p.m. solution), 2½ pounds of Leckenby's "Special Mix" and 1¼ pounds 82 percent 2-4-D cost $3.75 plus 25 cents for packaging per charge of chemical. Labor consisted of a nozzleman and a truck driver. Figuring labor cost at $2 an hour and truck operation at 20 cents a mile, this strip would cost $11.90 per mile sprayed, both sides of the road, exclusive of travel to and from the job, broken hose, etc.

To summarize, a standard tank truck with Griswold 1-inch fog nozzle and 6-foot applicator was used for roadside brush spraying. Of the various concentrations of sodium salt 2-4-D tried, it was found that the 500 p.p.m. solution was satisfactory. For a 500-gallon charge of this solution 2½ pounds of "Special Mix" and 1¼ pounds of 82 percent 2-4-D were used. Best results were obtained between mid-May and early July.

It is believed that this experimental work, together with that of other agencies, will form the basis for adapting this process to individual problems and available equipment.

Addendum

1951 Observations of 1949 Spraying

On May 8, 1951 the spraying of 1949 was again observed. These observations generally confirm those in the original report. Concentrations of 500 p.p.m. produce satisfactory results when properly applied.

Areas sprayed between mid-May and early July were satisfactory where proper strength of solution was used. Results of application after this time were erratic, and in most cases, not as satisfactory. Calendar dates for best results will vary, depending on the season's climatic effect on the annual growth of the trees.

Where properly applied, the spraying cleared the roads of foliage at a nominal cost, and the strip will probably require no more attention for several years. Where they are present the background trees will shade the strip so that regrowth will be obviated. Where trees over 12 feet high were pruned the top lateral branches are reaching out to provide shade for the trunks, thus assuring permanency of the treatment.

On the spraying in 1948 in Grays Harbor County, the treated strip, previously mowed, now shows no alder regrowth. On the other side of the road, mowed and not sprayed, the alder is now crowding out on to the road shoulder.

At this writing many miles of protection roads have been chemically brushed on tree farms in western Washington and Oregon, using the sodium salt form and the ester 2-4-D, with satisfactory results reported.

A Storage Container for Increment Cores

While working on a field problem which necessitated the making of a large number of increment borings, it became essential to take the borings into the laboratory for more critical study than was possible in the field. To keep the borings separate and in good condition is essential in such a study. The following device for doing this was devised and has proved to be entirely satisfactory.

One end of a large (milkshake size) soda straw is immersed in melted paraffin or parawax (the latter has a higher melting point) to about half an inch. With a finger over the other end to create a vacuum and hold the hot wax in the straw, the end is then quickly immersed in ice water to solidify the wax before it runs out of the tube.

The other end of the straw can be prepared by wrapping a number, typed on a small piece of paper, around it with cellophane tape. It may be necessary to sandpaper this end lightly to remove the wax if the tape is to stick properly. If an entire page of consecutive numbers is prepared in advance, they can be cut off of the page as needed and duplication will be avoided.

If desired, transparent straws can be used so that the increments can be examined without removing them from the containers. Also, different colored straws can be used for different species.

A simple quiver can be easily constructed to carry the straws in the field. Carrying the straws upright dispenses with the necessity for a stopper in the open end.

Increment cores should be inserted in these tubes with the bark end toward the opening. When broken, the segments should be placed in the proper order.

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First-Year Effects of Logging on Ponderosa Pine Forest Range Lands of Oregon and Washington

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EACH YEAR logging is done on 270,000 of the 13,000,000 acres of ponderosa pine forests in eastern Oregon and Washington. How this harvest of the timber crop affects range forage production is of great concern to the livestock industry of the region. Pine forest range lands provide 90 percent of the summer range area and 70 percent of the summer grazing capacity in the region. The demand for summer forage far exceeds the supply, and any factor that affects supply is of major importance. Consequently, livestock owners, range administrators, and big-game managers need to know the extent to which logging affects forage production so that they can make any necessary adjustments in management of their ponderosa pine ranges.

The effects of logging on ponderosa pine range have not been extensvely studied. Hormay (*7*) has made some observations on a tractor-logged Jeffrey and ponderosa pine area in northeastern California. He found that skidding and slash accumulations disturbed more than one-third of the area. Of the range plants present, the desirable grasses seemed to be most readily removed by logging. Fowells and Schubert (*5*) found that ground skidding with a crawler tractor denuded 22 percent of the ground surface in ponderosa pine-fir stands in California. They also determined that logging destroyed 72 percent of the tree reproduction less than 3.5 inches in diameter. Weidman (*10*) warned that masses of slash left following logging in the Pacific Northwest reduce available livestock forage for a few years and cause concentrations of livestock in openings, with resultant overgrazing.

In view of the lack of knowledge on the effects of logging, and the major importance of the forested type as summer range in the Northwest, the Pacific Northwest Forest and Range Experiment Station began a study in 1945 on the effects of logging on ponderosa pine ranges of eastern Oregon and Washington. This study was concerned mainly with tractor logging, the most common method for harvesting timber. Some supplementary observations were scheduled, however, for areas where log skidding was done with horses or a cable from a jammer.[1]

Additional measurements on denudation of soil and accumulation of slash immediately after logging were made on 15 temporarily located transects. Observations on temporary transects were made on 1/10-acre sample plots located at 5-chain intervals along the transects from a randomly chosen beginning point. These transects were frequently 1 mile long and crossed skid trails, tractor-tread scars, mashed tree reproduction, spur roads, log landings, piled and unpiled slash, small grassland openings, and undisturbed areas. Temporary transects were located on the Chelan and Wenatchee National Forests in Washington and on the Malheur, Umatilla, Whitman, and Fremont National Forests in the Blue and Cascade Mountains of Oregon. As a result, a variety of slopes, soils, timber site classes, and types of operations were sampled.

The soils of most of the Oregon transects were largely of basaltic origin. They were well drained, rather heavy textured and at least 10 inches deep. Transects on the Fremont National Forest were on soils of pumice origin. Some of these pumice soils are identical or similar to a series which has been tentatively named "Lapine." This series is a well-drained, coarse loamy sand of not less than 24 inches in depth. Soils on the areas sampled in Washington were generally light textured. Most of them were loams or sandy loams and were derived from granites, either weathered in place or weathered following transport by glaciation.

On the temporary and permanent transects, disturbance was classified into the following three major categories: (1) deep soil disturbance—soil displaced or torn up to a depth of one to several inches or even feet; (2) shallow soil disturbance—litter, humus, and tops of herbaceous plants cleared away and the soil displaced or torn up to a depth of less than 1 inch; and (3) slash covered—ground surface covered by slash and logging debris. Accumulations of bark and small needle-bearing branches which rot away in a year or two were not counted as slash.

The effects of these three categories of logging disturbance are much different in significance on range forage production and soil. By all odds, the most important is the deep soil disturbance because of its severe immediate and long-time effects. Nearly all types of vegetation except deeply rooted rhizomatous species are killed. Top soil is rooted out, pushed aside, or mixed with poorer soils of lower horizons; the soil is frequently compacted by the repeated passage of heavy tractors. Erosion is often severe. Natural recovery of vegetation is usually slow on ground which has had deep soil disturbance. In contrast, on ground where soil disturbance has been shallow, recovery is fairly rapid because many root crowns of grasses and weeds are uninjured and are able to regenerate new tops. Concentration of runoff and resultant erosion are not severe. Slash cover is of least significance. The coarser slash such as excavated stumps, cull logs, large branches, and heavy tops cover some vegetation and prevents livestock access to otherwise undisturbed vegetation. This

[1] On the cable-logged areas studied, a mobile, self-powered log loader operated along closely spaced spur roads. A cable was pulled out by hand, logs were attached, and then wound in to the road using power from the jammer engine. When the supply of logs was exhausted at one setting, the jammer was driven ahead on the spur road to another supply. This type of operation was used on areas which were too steep for safe operation of tractors.

coarser slash will continue to cover forage or prevent access for many years. However, its effects on the range are less serious, because the top soil has not been seriously disturbed.

In this paper, only the ground disturbance measured immediately after logging and the effects on vegetation measured the following growing season are presented. Data on disturbance are from 15 temporary transects and 3 of the permanent transects for tractor-logged areas; from 3 areas logged with cable; and from 2 areas logged with horses. Effects on vegetation are from the 4 permanent transects that have been logged over so far.

Disturbance to Vegetation and Soil Mantle Measured Immediately After Logging

The immediate effects of tractor logging were of major consequence to the range. Forage cover was at least temporarily destroyed or covered by slash on an average of one-quarter of the ground surface (Fig. 1). More than one-half of this soil disturbance was deep—in excess of 1 inch and often to a depth of 1 or 2 feet.

Cable logging showed slightly more total disturbance than tractor logging, but the intensity of disturbance proved much less severe. Cable logging resulted in deep soil disturbance on only 1.9 percent of the ground surface compared to 15.0 percent for tractor logging. Cable logging resulted in almost three times as much slash as did tractor logging, but slash was not so disturbing to the range as deep soil disturbance.

Horse logging proved less disturbing to the range than either tractor or cable logging. Only 16.6 percent of the ground on horse-logged areas was denuded of herbaceous and shrubby vegetation or covered by slash. Shallow soil disturbance and slash occupied much less ground than on cable-logged areas. Moreover, only 2.3 percent of the ground was scarred by deep soil disturbance compared to the 15 percent for tractor-logged areas.

The major ground disturbance on tractor-logged areas resulted from ground skidding of logs, con-

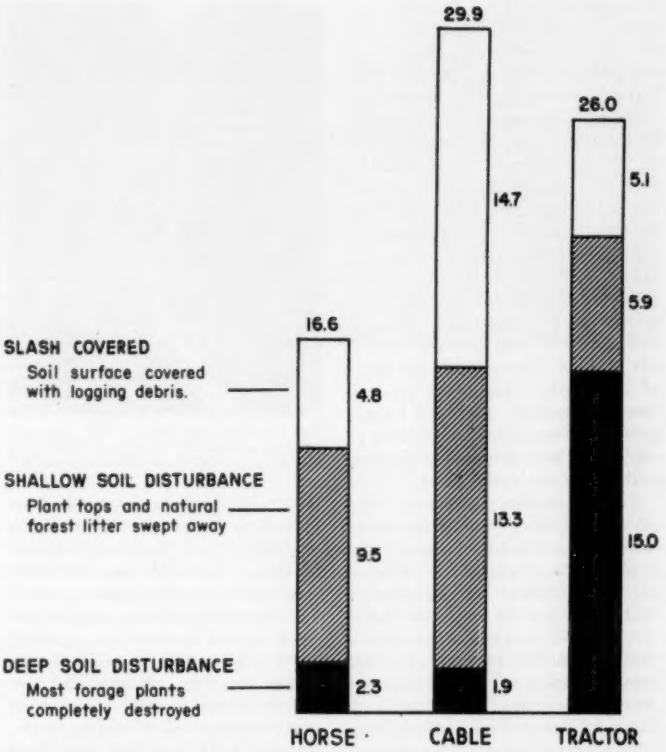

FIG. 1.—Percent of logged ponderosa pine range disturbed by horse, cable, or tractor logging, by type of disturbance.

FIG. 2.—Skid trails such as these are common on areas logged by heavy, crawler-type tractors. Soil disturbance to depths greater than 1 inch, similar to that shown in this photograph, was found on about 15 percent of logged-over range.

struction of spur roads, and construction and use of landings. In the process of skidding logs from stump to landing, the moving logs being pulled by the tractor tore out vegetation, displaced litter and dug into the soil along their path (Fig. 2). Where ground skidding was practiced, the forward ends of the logs seriously plowed the soil. This became even more serious when the logs were allowed to trail far behind the tractor. With repeated use, the denuded skid trails were deepened, soil compacted (Fig. 3), and the excavated material moved out to form berms along the sides of the trails. The scraping and clawing actions of the tractor treads hastened the development of skid trails and denuded additional portions of the forest floor.

Steep terrain increased the amount of deep soil disturbance caused by tractor logging. An analysis was made of the relation of the amount of soil disturbance to the percent of slope on forty-seven 1/10-acre plots where slopes varied from 0 to 60 percent. Plots having slopes of 40 percent or greater averaged 2.8 times more deep soil disturbance than plots with slopes of less than 40 percent. This greater amount of deep soil disturbance was caused, in part, by fewer possible logging roads and landings on steep terrain. As a result, skid trails were longer and more heavily used. The heavier use increased their width, and frequently gouged them out to a depth of 2 to 4 feet. Frequent sideslipping of tractors on the steeper slopes added to the amount of deep soil disturbance.

General soil texture was found to be another factor affecting the amount of soil disturbance from tractor skidding. In south central Oregon, 28 percent of an area with coarse pumice soil was denuded of herbaceous and shrubby vegetation by tractor logging, compared to only 18 percent of an area with finer-textured soil.

Method of logging influenced in a major way the amount of ground covered by slash (Fig. 1). Tractor operators usually skidded logs for greater distances and were able to maneuver their loads more easily

FIG. 3.—Repeated use of skid trails by tractors frequently results in deep soil disturbance. Soils are often compacted.

than cable loggers; as a result, they tended to use some skid trails repeatedly. This tendency resulted in the creation of less slash-type debris than in cable logging, where logs were pulled in a straight line from stump to jammer, mashing down patches of tree reproduction along the way. Horses did not smash freely through patches of tree reproduction to create numerous skid trails and add more slash to that from falling and bucking operations. The horse-logger was confined to a few, narrow, well-planned, and oftentimes hand-cleared skid trails (Fig. 4). The slash from felled timber was augmented only by material that the logger cleared from occasional patches of tree reproduction to permit passage of the horses. Thus only about 5 percent of the horse-logged area was made inaccessible by slash.

Method of slash disposal also influenced the effects of logging on the range. Piling and burning of slash increased the amount of disturbance because the fires destroyed practically all the plants and litter beneath the piles. Where tractors with slash piling teeth were used to push large snags, cull logs, tops, and smaller slash into piles for burning, the amount of soil disturbance was increased. Some of these effects of slash disposal were offset in a minor way by opening up of some areas of slash-surrounded or covered vegetation to livestock use. Lopping and scattering of slash were the least destructive to the understory vegetation and least disturbing to the soil.

Changes in Vegetation on Tractor-Logged Areas

Tractor logging had immediate effects on the forest stand. Reduction in tree crown density on the four permanent transects averaged 37 percent, while an average of 54 percent of the board-foot volume

FIG. 4.—Horse loggers were restricted to their few, narrow skid trails which were well-planned and frequently hand-cleared.

FIG. 5.—*Left*, before and *right*, after timber harvest. Crown density of forest canopy was reduced 58 percent, while 68 percent of the board-foot volume was removed from this area.

was removed (Fig 5). Numbers of seedling and sapling trees were reduced an average of 13 percent.

Herbaceous and shrubby vegetation were adversely affected by tractor logging. In the first growing season after logging, their densities on the four permanent transects averaged only 53 percent of the densities recorded just preceding logging (Table 1). Density losses were remarkably uniform, even though radically different growing conditions occurred in the years that the four transects were logged and during the following growing seasons. Reductions in understory vegetation of 47 percent seem higher than would be consistent with the average disturbance of 26 percent shown by all transects, even though the average disturbance for the four permanent transects was almost the same as for all other tractor-logged transects. Part of the lack of consistency resulted from the use of 1/10-acre plots for measuring disturbance and 100-square-foot plots for measuring vegetation change. Strictly by chance, the average disturbance on the 100-square-foot plots was 43.7 percent compared to an average of 24.4 on 1/10-acre plots of the permanent transects. From a regression of density reduction on disturbance using data from the 100-square-foot plots, the expected density reduction resulting from the 26 percent disturbance on the four permanent and all temporary tractor-logged transects would have been 33.2 ± 3.03 percent (odds 19:1).

Grass densities on the 100-square-foot plots of the permanent transects were reduced an average of 54.5 percent; weeds, 48.5 percent; and shrubs, 34.7 percent. Regressions of density reduction on amount of disturbance for these classes of vegetation were not significantly different from each other or from the regression for all vegetation. Therefore, the expected reduction for each class of vegetation resulting from the 26 percent disturbance on all transects would have been 33.2 percent.

Several factors may have been responsible for the observed differences in change between transects and classes of vegetation on the 100-square-foot plots. Differences in root system possessed by the major plant species—whether bunch-forming, tap-rooted, rhizomatous or stoloniferous—played an extremely important part. Likewise, weather of the first growing season after logging may have influenced the amount of change. Although it would have been desirable to calculate regressions testing the strength of these factors in influencing density reductions, insufficient data were available. However, careful observations in the field clearly showed that these were major factors influencing the magnitude of change.

TABLE 1.—DENSITIES OF HERBACEOUS AND SHRUBBY VEGETATION ON 100-SQUARE-FOOT PLOTS OF THE FOUR PERMANENT TRANSECTS BEFORE AND AFTER LOGGING AND THE CHANGES IN DENSITY ATTRIBUTABLE TO LOGGING

Class of vegetation and time of observation	Transect A Logged 1946		Transect B Logged 1947		Transect C Logged 1948		Transect D Logged 1946		Average	
	Percent									
All herbaceous and shrubby species										
Prior to logging	6.52		11.48		13.55		21.90		13.36	
First year after logging	3.76		5.87		7.22		11.45		7.08	
Percent change		—42.3		—48.9		—46.7		—47.7		—47.0
Grasses										
Prior to logging	3.32		3.52		2.56		12.90		5.58	
First year after logging	1.36		1.45		1.25		6.10		2.54	
Percent change		—59.0		—58.8		—51.2		—52.7		—54.5
Weeds										
Prior to logging	2.45		2.33		4.61		6.75		4.04	
First year after logging	2.02		2.07		1.12		3.13		2.08	
Percent change		—17.6		—11.2		—75.7		—53.6		—48.5
Shrubs										
Prior to logging	0.75		5.63		6.38		2.25		3.75	
First year after logging	0.38		2.35		4.85		2.22		2.45	
Percent change		—49.3		—58.2		—24.0		— 1.3		—34.7

The consistent heavy losses in density of grasses and grasslike plants occurred because the major species, elk sedge (*Carex geyeri*), pinegrass (*Calamagrostis rubescens*), Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), and Ross sedge (*Carex rossii*), were uniformly more susceptible to logging disturbance than were some of the more deeply rooted and rhizomatous weeds and shrubs. Rhizomes of sedges and pinegrass grew in the top 2 inches of the soil, and log skidding operations readily displaced them. These slender rhizomes were regenerative only so long as they were attached to a living plant. Once they were severed, they perished. Bunchgrasses, such as Idaho fescue and bluebunch wheatgrass were easily torn out of the soil by skidding. Their roots and root crowns dried out rapidly and the plants died.

Reduction in density of weeds differed widely between the four transects partly as a result of difference in susceptibility to damage of the species present and partly as a result of difference in weather conditions during the growing season subsequent to logging. Losses on Transects A and B were low because a high proportion of rhizomatous and creeping weeds such as lupine (*Lupinus* spp.), heartleaf arnica (*Arnica cordifolia*), western yarrow (*Achillea lanulosa*), and wild strawberry (*Fragaria* spp.) grew there. These weed species regenerated new tops from fragmented or unsevered rhizomes or stolens. Regeneration was aided by the good growing conditions of the seasons concerned. The weeds on Transect D did not make a good recovery because of the small proportion of rhizomatous weeds present there. On Transect C, the first growing season after logging was the summer of 1949, one of the driest growing seasons on record. As a result, growth of new tops by rhizomatous weeds in disturbed areas was meager and even the growth of undisturbed weeds was restricted. Although annual weeds made some increase in numbers subsequent to logging on each transect, none of the species had an appreciable density.

Shrubs showed considerable reduction in density as a result of logging disturbance on two of the four transects. The smaller density losses for shrubs on Transects C and D were primarily a result of chance; the sample plots that were not disturbed by skidding of logs supported most of the shrubs on these two transects. Where skid disturbance was shallow, pine-mat manzanita (*Arctostaphylos nevadensis*), dwarf blueberry (*Vaccinum cespitosum*), common snowberry (*Symphoricarpos albus*) and shinyleaf spirea (*Spiraea lucida*) should make rapid recovery, for these shrubs are either creeping or rhizomatous. Re-establishment following logging will be slow for shrubs which do not have vegetative means of reproduction. This is particularly significant in the case of antelope bitterbrush (*Purshia tridentata*), one of the most valuable browse plants for livestock and big game on eastern Oregon and Washington pine ranges. Supplementary observations made on this shrub show that it is badly injured or killed by logging.

The reduction in density of herbaceous and shrubby vegetation caused by logging reduces grazing capacity of the forested ranges. Even a temporary loss in density of perennial grasses reduces grazing capacity, for grasses are the most valuable and desirable forage plants on many pine ranges. On ranges where shrubs form an appreciable part of the understory, there is at least a temporary reduction in grazing capacity as a result of logging because most of the shrubs that have been reduced in density are valuable forage plants for livestock and big game.

Discussion

The average disturbance of 26 percent of the ground surface and the estimated density reduction of 33 percent in shrubby and herbaceous plant cover resulting from tractor logging make it clear that harvest of the timber crop on ponderosa pine ranges has a profound effect on soil and forage. Grazing capacity for livestock and big game is decreased. Of even greater importance may be the effects on watershed values. The data show large amounts of soil are bared of plant cover. Observations have shown extensive erosion from many of the bared areas. Extensive systems of skid roads and spur logging roads frequently concentrate surface runoff water and result in gullying. Skid and spur roads often sever normal underground water courses and speedily drain away the ground water. Compaction resulting from the repeated passage of heavy crawler tractors decreases infiltration and accelerates surface runoff.

How long it will be before the ranges recover fully, and the bare soil is healed over with perennial vegetation is not definitely known. This information will be provided as additional measurements are taken on the permanent transects. But it is not necessary to await the information on longevity of effects before steps are taken to utilize the available information in the management of logged-over pine range lands.

The immediate decreases in grazing capacity should be taken into account in managing livestock and big game ranges. A reduction in grazing capacity of from 25 to 50 percent will result in an overstocking of the range of from 33 to 100 percent unless reductions in stocking are made. Such overstocking for a 2-year period may be severe enough to weaken and kill the undamaged forage plants and start further deterioration on the range.

Steps should be taken to rehabilitate the bare soils resulting from logging, especially that in the deep soil disturbance category. Soil erosion and possible invasion by noxious or inflammable plants are threats so long as the soil remains bare. Reseeding to good perennial grasses and legumes, mechanical spreading of surface runoff that is concentrated by skid roads or spur roads, and temporary diversion of livestock can all be used in speeding rehabilitation (*6*).

Prevention of part of the disturbance is another major step to be taken. The smaller amounts of deep soil disturbance resulting from

horse or cable logging point to their use on steeper terrain. DeMoisy (*1*) has described the conditions for use of horses. Where tractor logging is used, better skid road, spur road, and main truck road layouts are essential. Improved logging machinery that will lessen the damage needs attention. Some logging accessories and machines which appear capable of lessening soil disturbance during logging have been reported on by the Forest Products Laboratory (*2, 3, 4, 8, 9*). More needs to be done along this line.

Summary

In a study of the effects of logging on Pacific Northwest ponderosa pine ranges, it was found that tractor logging denuded the herbaceous and shrubby vegetation from an average of 21 percent of the ground, and covered 5 percent more with slash. Logging with a cable from a jammer denuded 15 percent of the ground and covered 15 percent more with slash. Horse logging resulted in the least disturbance; only 12 percent of the ground was denuded and less than 5 percent of the ground was covered with slash. Deep soil disturbance occurred on 15.0 percent of the area logged by tractors, but on only 1.9 percent and 2.3 percent, respectively, of the area logged by cable and horses.

Measurements taken in the first year following tractor-logging on 100-square-foot plots of the 4 permanent transects, where average soil disturbance was 43.7 percent, showed that the density of all herbaceous and shrubby vegetation was reduced an average of 47.0 percent.

A regression of density reduction on disturbance was calculated from data taken on 3 permanent transects. Using this regression, a reduction of 33.2 percent in density of herbaceous and shrubby vegetation would have been expected from the 26 percent disturbance on all tractor-logged transects.

Reductions in quantity and quality of grasses were particularly serious to grazing values because of the major importance of the grasses for grazing.

Improved logging methods, along with revegetation of denuded areas to grasses may assist greatly in preventing depletion of range and watershed values of ponderosa pine range lands as a result of logging.

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Converting Scrub Oak Areas to Pine Plantations

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EXTENSIVE AREAS of formerly productive pine lands throughout the South are now occupied by almost worthless hardwoods. Some of this land has adequate pine reproduction which needs only release from the hardwoods to develop into merchantable timber. If the hardwoods are killed, either by girdling or by use of chemicals, notably Ammate (ammonimum sulfamate), the pine is given a chance to develop. This practice is being followed by many timberland owners with very good results and at a very nominal cost.

Other areas, however, have little or no pine reproduction and insufficient seed trees. If these lands are again to produce pine in a reasonable time, they will have to be planted. But what degree of success can be expected from such plantings, and what specific measures are needed to insure satisfactory establishment and rapid growth of the pine? A study started several years ago by the Southern Forest Experiment Station clearly shows that scrub oak areas can be successfully converted to pine stands by underplanting followed by release. The sooner the release, the better the stand of pine.

FIG. 1.—Many scrub oak areas in the South can be redeemed to timber production by underplanting with pine. The sooner the pines are released, the better. These loblolly pines, released the same season they were planted, are 3 years old. They average 4.3 feet tall; survival is 86 percent.

The Study

In February 1948, longleaf, slash, and loblolly pines (*Pinus palustris, P. caribaea,* and *P. taeda*) were planted in a moderately dense stand of scrub hardwoods (an average of 330 stems per acre) on cut-over longleaf land in central Louisiana. The trees were planted by hand at a spacing of 6 by 6 feet regardless of their proximity to hardwoods. The hardwoods consisted almost entirely of blackjack and post oaks (*Quercus marilandica* and *Q. stellata*). Their average diameter at breast height was 4.5 inches, with a range from 1 to 14 inches.

Some seedlings were released immediately after planting (March 1948), some one year after planting (March 1949), and others two years after planting (March 1950). There were also some unreleased check areas. Methods of release included girdling (conventional double hack), and Ammate applied as crystals in cups or notches cut in the base of the tree. Two degrees of release were tested: complete, in which all hardwoods over 0.5 inch in diameter breast high were treated; and partial, in which only hardwoods larger than 3.0 inches in diameter were treated.

Benefits from Release

The response of underplanted pine to release especially when done soon after planting, has been excellent. After three growing seasons, slash and loblolly pine that were released immediately after planting showed much better survival and growth than those not released, or those for which release was deferred one or two years (Table 1). The adjacent plantings of longleaf pine had similar trends until hogs destroyed them. First-year results showed that longleaf survival was 48 percent on areas released immediately after planting and 23 percent on areas not released.

The superior survival of loblolly pine (Table 1) was probably caused by a difference in the quality of planting stock. Nursery bed-run slash pine seedlings were used because there was insufficient stock to permit grading. A number of the slash pines which were planted would ordinarily have been discarded in grading. On the other hand, the loblolly was exceptionally good planting stock, of a large size, with well-developed root systems.

The good stand of pine established is somewhat remarkable in view of the fact that in 1948, during the first growing season, a record drought prevailed throughout this locality. Several thousand acres of new plantings on open grass sites were practically total failures. Yet, in contrast, released plantings in scrub oak stands in this experiment were successful.

Apparently, in years of severe drought, grass offers more competition than do hardwoods to pines during initial establishment. There

TABLE 1.—THREE-YEAR SURVIVAL AND GROWTH OF PINE AS AFFECTED BY TIME, METHOD, AND INTENSITY OF RELEASE

Release	Loblolly pine		Slash pine	
	Survival	Average height	Survival	Average height
	Percent	*Feet*	*Percent*	*Feet*
Time of Release				
Immediately after planting	86	4.3	46	3.4
One year after planting	62	3.2	36	2.3
Two years after planting	39	2.5	31	2.1
Not released	33	2.2	27	1.6
Method of Release				
Girdling	93	4.4	40	3.1
Ammate	80	4.2	52	3.7
Intensity of Release				
Partial	86	4.3	52	3.0
Complete	85	4.2	40	3.8

is of course less grass under hardwoods than in the open. The first-year survival of pines located under the crowns of hardwoods was higher than for those in the larger openings between hardwood crowns. For example, on areas not released, the survival for loblolly, slash, and longleaf trees that were under hardwood crowns was 62, 52, and 38 percent, respectively, as compared to 44, 27, and 16 percent for trees in openings between hardwood crowns. But where the hardwoods were deadened the survival and growth was even better. This may still be observed on the released areas, where the most pine and the best growth is to be found beneath or near groups of hardwoods that were deadened.

Apparently deadening the hardwoods increases the amount of soil moisture and nutrients available to the planted pines, and there is more sunlight than on areas where hardwoods are undisturbed. Soil aeration and drainage may also be improved by the death and decay of the hardwood root systems.

Method of Release

So far as pine response is concerned there was not much choice between the methods of release tested. The pine on the areas where the oak was girdled appears to be as good as that on the Ammate-treated areas (Table 1).

The Ammate treatment gives a quicker crown kill, and results in less sprouting than does girdling. However, sprouts do not seem to be interfering much with the development of the pine at this stage. In fact, the prompt response and rapid growth of the pine makes it doubtful whether sprouts ever will be a serious problem. Sprouting was common only on the smaller girdled trees, mainly under about 6 inches in diameter. Possibly sprouts may prove troublesome with longleaf pine. Because of longleaf's characteristic slow start in height growth, hardwood sprouts may reach considerable size before the pine seedlings can get out of the grass.

One of the main considerations in a choice of methods is cost. This study did not provide reliable cost data on a practical scale. In tests elsewhere, the Ammate method has not cost much more than girdling. Furthermore, other methods of Ammate treatment are available at a lower cost. Some landowners are applying Ammate in solution poured in frills cut at a convenient chopping height. The results in terms of crown kill and sprouting are somewhat intermediate between girdling and the Ammate cup-crystal method tested in this study.

Probably there is no single best method of release. Local conditions with respect to labor, size, and density of the hardwoods, and the species, size, and amount of pine to be released will dictate many variations in any method. All methods have their place, and all are being used successfully. The main point is that time of release is much more important than method.

Intensity of Release

As with methods, there was little or no difference in pine response between the two intensities of release tested (Table 1). Partial release opened up the hardwood overstory considerably because many of the trees were over 3 inches in diameter. Where most of the hardwoods are smaller and form a dense stand, some opening up in the smaller sizes is desirable—the exact amount will vary according to the local stand conditions. For releasing natural reproduction, the best technique probably is to treat only those hardwoods seriously competing with pine. But with pine planted at regular intervals and therefore more uniformly distributed than natural reproduction, such selective release is inapplicable, especially when made at the time of planting and before mortality has occurred.

Conclusions

This work has demonstrated that scrub oak areas can be successfully converted to pine stands by underplanting, provided the pines are released soon after or at about the time of planting. Deferring release results only in lower survival and delayed growth. Although the expense of plantation establishment will be more than on open sites, the better survival and growth on scrub oak areas may partly compensate for the greater cost. Either girdling or poisoning is a good method of release. The choice of methods depends largely upon local conditions—and personal preference. This is true also for the intensity of release. Ordinarily, it will not be necessary to deaden all the smaller hardwoods. An intensity based on a diameter limit, varying according to local stand conditions, is best for planted pine stands. For natural stands, it may be better to deaden only those hardwoods directly interfering with the pine.

Tree and Shrub Investigations in the Southern Great Plains[1]

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EXPERIMENTAL WORK with trees and shrubs in the southern Great Plains dates back to the establishment of the southern Great Plains Field Station at Woodward, Okla., in 1914. At that time the station was under the administration of the Office of Dry-Land Agriculture Investigations, which had a keen realization of the value of trees and shrubs in the area. Planting of trees and shrubs started as soon as a few necessary buildings were completed. Many of the original plantings made in 1916, 1917, and 1918 are still evident on the station grounds. Introduced materials were planted in the early days, and the continued interest in trees and shrubs finally resulted in the establishment in 1931 of a long-term experimental program.

The program was set up to determine what species of shade, ornamental, fruit, and windbreak trees, shrubs, and vines are best adapted to the Woodward area and to all parts of the southern Great Plains, and the best methods of planting, propagation, pruning, training, and general management.

In order to find out what species could be used in the area, extensive species tests were made at Woodward and smaller species test plantings were established at the other experiment stations in the southern Plains. As the tests continued, the most promising species were used in cooperative experimental plantings. The cooperative plantings were made in various counties in the five-state area in cooperation with the Extension Service. Cooperators were selected and recommended by the various county and home demonstration agents. Inspections were made of the sites and plans drawn to suit the planting sites.

Boundaries and Climatic Factors

The southern Great Plains is considered to be the area bounded on the north by the counties bordering the Arkansas River in Colorado and Kansas, on the east by the 98th meridian, the west by the Rocky Mountains in Colorado and New Mexico, with an extension of the southern line of New Mexico across Texas as the southern boundary. This area comprises over 160,000 square miles.

The total annual rainfall in the drier parts of the southern Great Plains can be deceptive in estimating how much will be available for plant growth. The area is often subjected to severe storms, when 3 or 4 inches of rain will fall in a few hours' time. Much of this moisture is lost, even though the planting site might be contoured or the plantings made on terraces. Such man-made structures are often washed away in a few hours. In the major part of the southern Plains the amount of snowfall is limited. Therefore advantage cannot be taken of drifting snow that might build up in a windbreak and increase the total amount of available precipitation for the planting site. Slightly over two-thirds of the annual precipitation occurs during the growing season, which makes it very desirable to conserve all that falls at that time.

Another climatic factor that plays an important role in plant growth in the southern Plains is the almost constant wind. No one is ever lost on the Plains if he is in sight of a tree. You can always tell direction by the "lean" of the trees to the north (Figs. 1 and 2). The average monthly wind velocity at Woodward is: Jan., 7.2 miles per hour; Feb., 8.0; March, 9.1; April, 9.0; May, 7.4; June, 7.3; July, 6.7; August, 6.3; Sept., 7.0; Oct., 6.7; Nov., 7.0; Dec., 7.0.[2] For the growing season, April 1 to September 30, the average is 7.3. The annual average is 7.4 miles per

FIG. 1.—A young cooperative experimental windbreak on an upland site in southern Hemphill County, Tex. Planted on the contour, the windbreak completely encircles the ranch homesite.

FIG. 2.—Interior view of windbreak shown in Figure 1. Note the wide spacing between rows and between trees. Redcedar on the right, smooth honey locust on the left, with desertwillow in the border row beyond.

[1]Paper presented at the winter meeting, Ozark Section, Society of American Foresters, Fort Smith, Ark., Feb. 3, 1950.

[2]Velocity readings taken at 2 feet above the ground.

hour. To the despair of the plainsman, the greatest wind velocity is usually recorded in the months of March and April. These two months are very critical in terms of establishment of trees and shrubs. The relation of wind movement to transpiration of plant materials can be appreciated by studying the amount of evaporation from a free water surface. For the 6-month growing season, the total evaporation from a free water surface at Woodward is 51.5 inches. The rainfall for this same period is 15.9 inches. Thus the evaporation from a free water surface during the growing period is over 3 times the actual amount of precipitation.

Westward, toward the Rocky Mountains, this ratio is increased. At the Northeastern New Mexico Substation, Tucumcari, N. Mex., the evaporation from a free water surface during the past 13 years has been approximately 5 times the precipitation for the growing season.

Other climatic factors that play a role in the establishment and maintenance of plant materials include early fall freezes, late spring freezes following mild mid-winter weather, hail, sleet, and occasional dust storms.

Topography and Soil

Along the eastern fringes of the southern Great Plains the elevation is less than 1,000 feet; in the foothills of the Rockies it is approximately 6,600 feet. This wide range in elevation lends interest to the study of the species that will survive. The common southern species that prefer a relatively warm climate and a long growing season are out of place in the higher elevations where cool climates and short growing seasons prevail.

Reforestation problems of most foresters are as a rule confined to the establishment of trees on cutover or burned-over areas that are in *true tree sites*, whereas on the Plains the forester is confronted with the problem of growing trees on sites that are definitely *not* true tree sites. The soils over a major portion of the southern Great Plains are generally fertile, but vary widely in composition.

FIG. 3.—A cooperative experimental windbreak in the rolling hills area of western Union County, New Mex. This planting site has an average annual precipitation of about 14 inches.

Too often a windbreak planting problem is located on a hilltop chosen as a building site only because of the view it afforded, with no thought given to the soil. There may be several inches to several feet of top soil with an underlay of impervious hardpan, caliche, or rock. Many shallow-soil planting sites have had to be classified as absolutely impossible for tree growth unless individual large holes are excavated and refilled with a loam soil. It has always been a pleasant surprise to find that, in general, the more difficult the planting site, the more determined the plainsman is to establish trees. Many thousands of hours have been spent in establishing and maintaining small farmstead or ranch home plantings just because the owner was determined to have trees.

Plan of Cooperative Distribution

The plan of cooperative experimental distribution has been to keep the total plantings to as small a number per county as is feasible. The planting sites are chosen on the basis of their being representative of a community. In most counties, from 5 to 8 plantings in various parts of the county will give a satisfactory test of the varied soil types. A plan for windbreaks and ornamentals is made for each planting site in cooperation with the Extension Service representative. In all cases, the plan is for a particular site, rather than a standard plan modified to suit a planting site. No plantings have been made for protection of field crops. The windbreaks are truly windbreaks for farmstead protection and are not to be confused with shelterbelts made for crop protection.

In the windbreak and ornamental tree distribution, the annual list often has included 40 species and varieties of deciduous and coniferous trees. The ornamental and protective shrub planting list has included as many as 125 species, varieties, and selections of woody shrubs. From 1931 to the present time we have distributed over a quarter million trees and 150,000 shrubs and vines. In addition we have included perennials, grapes, and other fruits in many of the cooperative experimental plantings. The total of all types of plant materials distributed to date amounts to 472,655 units. More than 750 cooperative plantings have been established in 114 counties in the 5-state area.

General Results of Cooperative Plantings

This discussion of results is limited to the windbreak plantings.

Species.—Of the many species under observation, the most useful for average planting sites in a major portion of the area are redcedar, Austrian pine, ponderosa pine, Rocky Mountain juniper, single-seeded juniper, parvifolia elm, Chinese elm, and smooth honey locust. For limited use on selected sites the list includes Arizona cypress, Chinese arborvitae, shortleaf pine, loblolly pine, Scotch pine, Arizona ash, green ash, American elm, eastern hackberry, cottonwood, sycamore, Chinese jujube, osage orange, Russian mul-

FIG. 4.—A cooperative experimental farmstead planting near House, New Mex. This is located on top of the escarpment in an area entirely devoid of native tree and shrub growth.

berry, and Chinese pistache. During the life of the station we have been fortunate in finding an exceptionally good selection of the smooth honey locust, several satisfactory selections of the parvifolia elm, a hardy Arizona cypress, and a vigorous selection of redcedar. These selections have been incorporated in the cooperative experimental plantings when funds for propagation have permitted.

Planting.—The problem of how to plant coniferous trees successfully in the southern Great Plains has not been satisfactorily solved. A reasonable degree of success has been attained with the deciduous species, but conifers still pose a problem. Results over a number of years have shown that bare-rooted conifers show a survival ranging from zero to almost 100 percent. Survivals of over 75 percent can be obtained only about once in every 5 years. All methods of handling, such as care in digging and transporting, protection from exposure, etc., being equal, the end result with bare-rooted conifers is still dependent upon the weather during and just after transplanting. All the usual methods of dipping seedlings in various solutions have been tried and have been found wanting. With the chance for good survival of only once in every 5 years on an average, the long-time planting program becomes a hazardous one.

In 1935 the use of bare-rooted coniferous stock was practically abandoned. Experimental cooperative plantings are relatively small in size, requiring usually less than 100 coniferous trees, and operators were willing to handle potted, canned, or balled and burlapped evergreens if their chances for survival were more than 75 percent. We found that 90 to 95 percent survival could be obtained by handling the trees with a cylinder of earth. A practical way of planting several hundred thousand conifers in a large program is still to be found. One solution has been to grow the seedlings at a central nursery, send a sufficient number of plants to a location convenient to four or five counties, where they would be transplanted to paper or metal containers and grown for one season. They would then be ready for distribution in a 30- or 40-mile radius and could be called for by the purchasers. This plan has been discussed with some of the extension foresters in the respective states and is under consideration. It involves the help of a forester or a county agent who has a very active interest in sponsoring such a program. This method was actually carried out one season in Ochiltree County, Texas, and found to be practical when only a few thousand trees were involved. A high percentage of survival was reported.

Spacing.—The major factors involved in the problem are amount and distributions of rainfall, evaporation, length of growing season, location and type of soil. In the 22- and 23-inch rainfall zone we have found that 150 square feet is needed per tree for many species. When aggressive species are in rows adjacent to slower growing species, a greater spacing will be required. Westward, our results indicate that spacing has to be increased in inverse proportion to the rainfall. We have not had sufficient time to make observations on a large enough number of plantings so that our spacing results can be conclusive. Our first plantings are now 19 years old which is relatively young if one considers the life-expectancy of tree species.

Forestry Needs for the Southern Great Plains

Cooperative experimental plantings.—The only way to obtain practical results is to have typical plantings scattered over as wide an area as can be handled. The results obtained at one or two key points have very limited application. Some form of experimental planting that would be subject to uniform management would be the ideal arrangement; but this probably could not be achieved because of the expense involved.

A long-term breeding program.—We have been testing common tree species and have been able to do only a limited amount of work with selections. A major portion of the southern Great Plains is a treeless area that cannot be regarded as affording true tree sites. We have reached a point where it is essential that trees should be *made* for the area, rather than to continue to try to make the area fit the trees. The foundation stock for such a program exists at the present time. What is needed is a long-term tree breeding program. Trees are crops. When the sorghums were found to be useful as row crops in parts of the southern Great Plains, an intensive breeding program was started which has produced varieties of sorghums that have extended the use of this crop over almost the entire area. So it can be with trees.

Expansion of Plains forestry education.—The Extension Service is doing an excellent job with the available personnel. These individuals are all too few to meet present demands on their time. We find that the same mistakes in election of species, spacing, and management as were made 20 years ago are often being repeated today. These mistakes can be lessened only when the area is staffed by a sufficient number of well-informed foresters who can guide the work. In many parts of the area there should be a trained farm forester for every four or

five counties. This program is being given careful consideration by several states.

Quality versus quantity. — We annually read tables of figures stating how many thousands, hundred thousands, or millions of trees were planted by various organizations during a given period. In localized areas having *true tree sites*, these figures have a definite meaning, but in Plains forestry, they become meaningless. What counts in the Plains is the actual percentage of survival. To plant trees repeatedly, as has been done in the past, and have little or no survival is actually harmful to the over-all forestry program. To plant 100 trees and have only 10 or fewer trees live may actually be worse than having made no planting. To provide good stock in condition to withstand the shock of transplanting, should be the aim of every Plains forester. This ultimately means that we will have to give consideration to the type of country in which the plantings are to be made and make a sincere effort to obtain a survival of 75 percent or more. Our efforts will have to be centered upon *quality* rather than on *quantity*.

Any new work should be patterned to the type of country, rather than to try to make the country conform to an age-old pattern found in areas that are more suitable for tree growth. A research program based on a long-term plan can be successful. Any short-term tree adaptation project would be inadequate and should not be undertaken.

Site Index of Oaks in Relation to Soil and Topography in Northeastern Iowa[1]

Dean Einspahr and A. L. McComb

Respectively, technical assistant Gamble Brothers, Montgomery, Ala., and professor of forestry, Iowa State College, Ames.

PROPER FOREST MANAGEMENT hinges on the prediction of the productive capacity of the land. Site index based upon height of dominant and codominant trees at some reference age such as 50 or 100 years is one of the most common guides used in the prediction of the productivity of forested areas.

Often foresters find themselves with the job of determining the site index of brush land, abandoned farm land, or immature stands of timber. On areas with similar climates, soil profile characteristics and topography appear to be the most feasible guides to site index prediction.

Auten (*1, 2*), Coile (*3, 4*), Gaiser (*5*), Lunt (*10*), Tarrant (*13*), Turner (*14*), Storie and Wieslander (*12*) and Westveld (*15*) are just a few of the many authors who in recent years have made studies in various parts of the country in which soil properties have been correlated with forest growth. Physical soil properties rather than level of soil nutrients have generally been found to be more important in the prediction of forest tree growth, although physical and chemical properties are closely interrelated and their effects cannot be separated.

The study being reported was made to determine the site indices of oaks growing on the major soil types of northeastern Iowa and to relate site index to the profile features and the characteristics of these soils and to topography. Soil depth, topographic position, aspect, percent of slope, and certain physical properties of the soil profiles were found to be related to site index. Site indices of eastern white pine and oaks were compared on several of the soils.

Region

The study was limited to the four northeastern counties (Allamakee, Clayton, Winneshiek, and Fayette) of Iowa. The extreme western part of the four-county area has a rolling topography and the soils are derived from glacial drift materials. These soils were not considered in this study. The eastern part of the area shows little evidence of glacial influence and the topography is exemplified by steep-sided valleys and high intervening ridges.

The soils studied have been derived from medium-textured loess, residual limestones and sandstones, and from alluvium and colluvium. They represent a wide range in texture and in surface and internal drainage. Figure 1 shows the relation of parent material and topography to several of the major soils of the area. A more complete description of the soils can be found in the *Principal Upland Soils of Iowa*.[2]

Precipitation for the area averages from 32 to 34 inches annually and approximately 60 percent comes during the months May thru September. The average frost-free period ranges from 150 to 160 days. January temperatures average 16° to 18° F., July temperatures 72° to 74° and the mean annual temperature is 45° to 46°. Relative humidity at noon in July averages 50 - 55 percent.

The principal upland timber types of the area are similar to cover types 49 (white oak-black oak-red oak) and 49a (white oak-black oak-hickory) of the S.A.F. and are like the "mixed oak" type described by Gevorkiantz and Scholz (*7*). Red and white oaks are the principal species. On dry sites (sandy soils, shallow soils, upper slopes, ridge tops, and south and west aspects) the percent of

[1]Journal Paper No. J-1904 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 1153.

[2]Reicken, F. F. and Guy D. Smith. Principal upland soils of Iowa. Iowa Agricultural Extension Serv. and Iowa Agricultural Experiment Sta. June 1949.

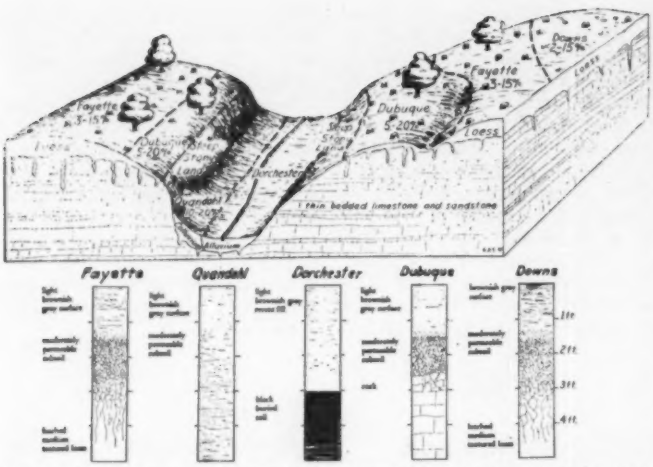

FIG. 1—Relationship of major upland soils in northeastern Iowa. (From the Agricultural Extension Service, Iowa State College, Ames.)

Hill's oak, bur oak, and hickory increases. The moisture sites (deep loams, sandy loams, and silt loams on north and east aspects) have more red oak, as well as sugar maple, basswood, black walnut, butternut, white ash, and elm.

Methods

The basic data for the study were obtained from 108 site index plots and 16 volume plots taken on 10 upland soil series or land types occupied by oak and oak-pine stands. Plots were selected with the aid of aerial photographs, with soil types mapped on them. Site index plots were confined to stands 60 years of age and older in order to measure trees whose height growth had been largely completed, and to avoid possible errors caused by site index curves of different shapes on the several soils (See Lorenz and Spaeth (*9*)). All site index plots were located in well-stocked stands, or in stands that had developed for most of their lives as dense stands, in order to avoid differences in tree height associated with density of stocking (Gevorkiantz and Scholz (*6*)). Height and age measurements were made on four or five dominant and codominant trees on each plot and average values for each plot were obtained. A complete description of the soil profile on each plot was obtained from a soil pit and soil auger borings. The composition and character of the stand, the aspect, the topographic position, and percent of slope were described for each plot. Cubic volume was determined on sixteen 1/5-acre plots distributed through the more important soil types for the purpose of making rough comparisons of yields on the different soils.

Site indices for oak were determined from the curves published by Schnur (*11*) and site indices of white pine from the curves of Gevorkiantz and Zon (*8*). Comparisons of the site indices of white oak and red oak and of white

TABLE 1.—SUMMARY OF SOIL CHARACTERISTICS AND SITE INDEX

Soil Series	Textural composition A	Textural composition B	Horizon thickness A	Horizon thickness B	Horizon thickness Total	Permeability Sub soil	Natural internal aeration	Moisture condition due to topographical position	Percent slope	Site index
			1-2	*Inches*						
Chaseburg-Judson	Silt loam	Silt clay loam	14	16	D[1]	Moderate	Good	Very good	4	64
Fayette	Silt loam	Heavy si. lo.	10	16	D[1]	Moderate	Good	Fair	15	60
Quandahl	Silt loam to sandy loam varying amounts of rock fragments.		14	12	D[1]	Moderate	Good	Good	25	57
Dubuque	Silt loam	Heavy silt loam	10	16	30	Moderate	Good	Fair	18	55
315	Clay loam to sandy loam varying amounts of rock fragments.		—	—	18	Moderate	Good	Good	10	52
Steep Stony N-aspect	Clay loam to sandy loam varying amounts of rock fragments.		—	—	—	Rapid	Good	Poor to good	40	52
Chelsea	Loamy sand to sand		—	—	D[1]	Very rapid	Good	Fair	10	44
Steep stony S-aspect	Clay loam to sandy loam varying amounts of rock fragments.		—	—	5	Rapid	Good	Very poor to fair	40	37
Zwingle	Clay loam	Heavy clay	12	15	12	Very slow	Very poor	Fair	1	36
Sogn	Silt clay loam	Clay loam	—	—	8	Rapid	Good	Poor	8	33

[1]Greater than 36 inches.

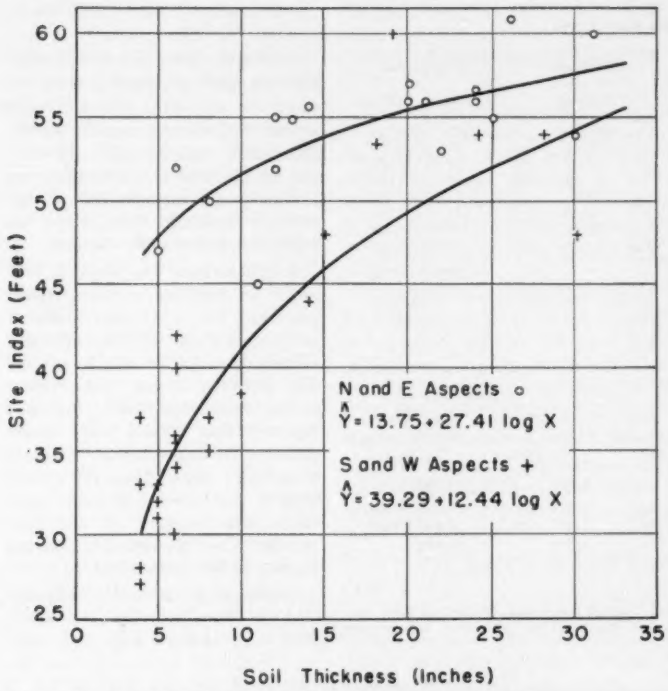

Fig. 2—Relationship of site index and soil thickness.

pine and oak were made on a number of the different soils

Discussion of Results

Table 1 summarizes some of the more important characteristics of the 10 soil series and land types studied and gives average site index values for each. Total horizon thickness used in Table 1 refers to the average depth of soil material to unconsolidated or consolidated bed rock or to tight subsoil. "D" as used in this table indicates soil depth greater than 36 inches. The description of permeability of subsoil and natural internal aeration are taken from *Principal Upland Soils of Iowa.*

The lowest site index (S. I. = 33) was found on Sogn soil which is a very shallow soil over limestone, or limestone-sandstone, occurring on exposed ridges. The second lowest (S. I. =36) was Zwingle which is a high terrace soil found along the Mississippi River and adjacent small streams, and has formed from sediments presumably laid down when the Mississippi River was dammed by glaciers. The timbered Zwingle occupies protected positions but is very fine-textured and the B horizon is very impermeable. Steep stony land on southerly and westerly aspects with a very thin soil mantle gave a site index of 37 and the coarse-textured sandy but deep Chelsea, an index of 44. The site index improved as the thickness of the soil mantle increased and as the texture changed from sand or loamy-sand to silt loams of good structure.

Figure 2 illustrates the effect of soil mantle thickness on site index for northerly and easterly and for southerly and westerly aspects. Data from Sogn and Zwingle, and for the soil types more than 36 inches deep have been omitted from the graph. T-tests showed a highly significant relationship between soil thickness and site index. Depth of soil exerts more influence on southerly than on northerly aspects.

The relation of aspect to site index is illustrated in Figures 2 and 3. In the area studied there are striking differences in the tree growth on northerly and easterly, as compared to southerly and westerly aspects. An analysis of variance showed that the general aspects were of different populations. Figure 2 shows that soil depth and aspect are not confounded to any important degree although soils

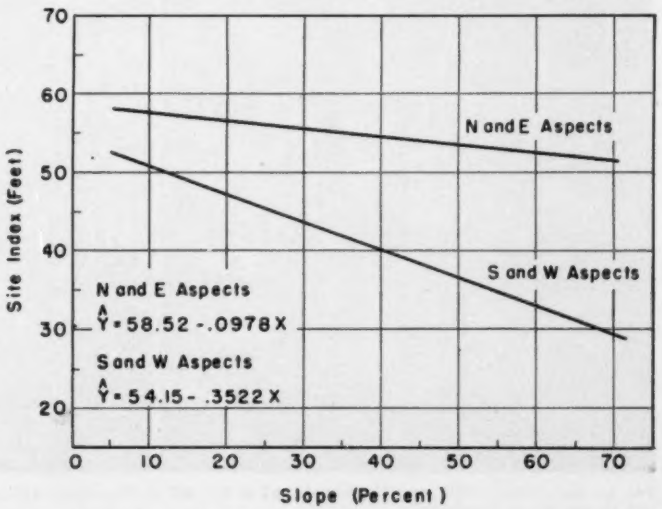

Fig. 3—Relationship of site index and percent of slope.

TABLE 2.—COMPARISON OF SITE INDICES OF EASTERN WHITE PINE AND OAKS IN MIXTURE ON SEVERAL SOIL TYPES

Soil series or land type	Aspect	Thickness of soil material	Site index	
			Oak	Pine
		Inches		
Steep Stony	NE-NNE	20-21	57	58
Steep Stony	NW	6	52	62
Dubuque	WNW	33	51	60
Dubuque	W	30	51	56
Chelsea	W	D	51	64
Steep Stony	SSW	10-12	39	48
Sogn	SSW	5	33	47
Average			48	56

TABLE 3.—COMPARISON OF VOLUMES IN OAK AND WHITE PINE-OAK STANDS ON SIMILAR SITES ON DUBUQUE SOIL

Cover type	Site index, oak = 60		Site index, oak = 55	
	Volume per acre Cu. ft.[1]	Volume per acre Bd. ft.[2]	Volume per acre Cu. ft.[1]	Volume per acre Bd. ft.[2]
Oak	4,470	22,370	3,022	12,240
Pine-oak	4,029 (Pine) 2,026 (Oak)	25,620 (Pine) 11,650 (Oak)	4,201 (Pine) 1,427 (Oak)	26,180 (Pine) 7,480 (Oak)
Total	6,055	37,270	5,628	33,660

[1]Trees 2 inches d.b.h. and up.
[2]Volumes to 4 inches top diameter for trees 6 inches d.b.h. and up; Int. ¼ inch rule.
[3]Ages: Pine 75 to 80 years; oak in pine-oak stands 75 to 150 years; oak in pure oak stands 75 to 80 years.

on the southerly aspects tended to be more shallow.

Figure 3 shows the relationship between site index and percent of slope for northerly and southerly aspects. T-tests showed a highly significant relationship between percent of slope and site index for southerly and westerly but no significant variation with slope on northerly and easterly aspects.

A comparison was made of site index in relation to topographic position. The plots were classified into upper slope, middle slope, and lower slope. Differences in site index between lower and middle slopes were significant, but not between the middle and upper slopes. An inspection of the basic data for plots otherwise alike showed that the lower slopes generally had thicker soil and that soil depth and topographic position tended to be confounded.

Considering all soils it appears that the very poor sites are those with very shallow soils over bed-

FIG. 4.—*Left*, eastern white pine, 75 years old and 90 feet tall on Steep Stony soil 24 inches deep. *Right*, red oak 80 years old and 80 feet tall on Fayette soil.

rock and very coarse-textured soils, both of which do not supply enough water to meet the needs of the trees growing on them, and in addition, the soils like Zwingle which although moist are extremely fine-textured, impermeable, and poorly aerated. Recent plant physiology literature indicates that roots grow very slowly and function inadequately in poorly aerated soils and that such soils may be physiologically as dry as the sands or very thin soils.

Eastern white pine (*Pinus strobus* L.) grows naturally in northeastern Iowa in areas of rock outcrop, and is usually associated with oaks. Table 2 gives a comparison of the site indices of pine and oak on several of the soils. There is an average of 8 site index points difference in favor of pine. In general, the greatest difference is found on the poorer oak sites.

Table 3 is a comparison of stand volumes of oaks with oak-pine on two areas of Dubuque soil. The oak-pine plots were considered fully stocked and the oak plots corrected to 100 percent density using basal area as a criterion. The higher volumes in the stands with pine reflect the higher site indices for pine, the longer clear and usable bole lengths, and the greater number of pine stems per acre. These data indicate the magnitude of differences in returns to be expected when the percentage of pine in the stands is increased.

Summary

Site index of oaks was studied in relation to soil series, soil profile characteristics, and topography on 108 site index plots and 16 volume plots in the Fayette-Dubuque-Stony soil association area of northeastern Iowa. Soil and topographic features which affect the availability of moisture for growth appeared to be correlated with site index. The principal findings were:

1.—Site index was found to be correlated with certain major soil characteristics which are used in describing and defining a soil series. The prediction of the site index of oak for various soil series and miscellaneous land types seems entirely feasible.

2.—The average site index values for oak ranged from 64 on Chaseburg-Judson soils to 33 on Sogn soils.

3.—Stand composition was found to be related to the soil series and topography.

4.—Thickness of soil material to unconsolidated bedrock was found to be directly related to the site index. A curve of the form $\hat{Y} = a + b \log X$ best fitted the data.

5.—North and east aspects were found to have site index values 8 to 12 points higher than similar sites on south and west aspects.

6.—Differences in site index values due to topographic position appeared to be caused by related factors that affect the total available moisture.

7.—Site index values were found to decrease as the percent of slope increased. This relationship was found to be highly significant on the south and west aspects but not significant on north and east aspects.

8.—Where eastern white pine was growing in mixture with oaks on the same soil, pine had higher site indices, and the site index differences were greatest on the poorest oak sites. On the same site stands with white pine carried much greater volumes at the same ages.

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Test Tube Potentials[1]

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THE POTENTIALS in the field of forest products development are tremendous, for after all, wood is two-thirds cellulose and cellulose is the basic material from which thousands of things can be made. Probably a utility of 40 percent of our harvested trees constitutes the present average maximum. Most of the remaining 60 percent which we now discard as useless is, strangely enough, composed of the same basic raw materials as the usable portion.

Hence, one can accurately state that we now value cellulose, but only when it is in a certain physical form. The chemist will tell us that if he is given the opportunity, he can rearrange these chunks of cellulose and lignin so that 100 percent, and not 40 percent, of a tree can be made into useful products. The problem, therefore, would appear simple. All we have to do is to give these scientists an opportunity to go to work and presto the job is done.

Unfortunately, this is only a half-truth because there is that little thing called "economics." We have in this day a plague of communism which is a threat to our national existence. Communism is of course ideology that cannot work, chiefly because the laws which govern economics are violated.

Revolution, preceding evolution is seldom successful. This is as true for technical development as in any other human endeavor. We simply cannot afford to be communists in our technical development. A slow economic evolution is perhaps more important in attaining our objectives than an all-out endeavor to develop scientific information.

Economic Problems

Not long ago a thought-producing book dealing with developments in wood utilization was published. It painted a horrible picture of what this country is coming to unless we immediately put into practice the technical advances that have been tried out in Europe. Among the things recommended were wood-burning gas generators and the production of alcohol from wood. With respect to the former, the author indicated that we Americans had not tried it. As a matter of fact, the European gas generating equipment was tried by many people in the United States and proved to be economically unsuccessful even during a period of gasoline rationing.

The failure to use wood sugar processes was attributed to the selfish interference of vested interests who were afraid of wood sugar as a competing material. This is not true. On the contrary, it is likely that these so-called vested interests were little concerned with the wood sugar alcohol developments; they knew the economics of alcohol production far better than the chemists and wood technologists. It is understandable that the manufacturers of competing materials would not be too happy to lose their markets. but the failure to use either of the recommended processes on a large scale was merely a matter of adverse economics.

For example, gas generators are rather widely used in Europe and are quite satisfactory. In Europe, gasoline has always been relatively expensive. In the United States the manufacturing cost of gasoline is probably less than 5 cents a gallon. The remainder of the retail price is for distribution, transportation, and taxes. In most states the taxes are more than the original manufacturing costs. Now if we use wood, the cost for raw materials in usable form will be about as much as the cost of producing gasoline. The transportation cost to the consumer might be less, but it would probably be more and since someone has to pay for our roads, the taxes would be the same. If and when a crude oil shortage takes place, the present type of wood gas generator may come into use, but even that is doubtful, because by that time our original thinkers will come up with a much better idea. We Americans believe in buying new models.

Wood sugar is a different matter. Alcohol, feeding yeast, and other products that can be made from it are in demand, and the cost spread between wood sugar and competitive materials is not too great. The economics in this field are slowly drawing together, and eventually wood may be one of the basic raw materials used in manufacturing synthetic rubber, smokeless powder, or even potable liquors. It was thought that this industry might get under way as an aftermath of wartime activities, but the favorable economic balance was temporary. Probably a more favorable permanent condition will develop, in which case wood sugar plants will mushroom.

Premature exploitation of new processes is always dangerous and may result in retarding or in extreme cases stopping development. However, the writer prefers to believe that progress will usually come if the technical development has been sound and the exploitation is properly timed to coincide with favorable economic conditions.

No one wants to be communist whether it be through the violation of social laws or the prostitution of safe and sane developments in scientific advancement. Therefore, with these reservations in mind, it may be in order to do a little forecasting and to tell what one person believes may be in store for us.

Wood and the Soil

Wood is a product of the soil, but the soil like all other things, if abused, will not continue to produce the things that we require of it. Therefore, in considering what to do with the waste from our mills

[1]Paper presented at the Golden Anniversary Meeting, Society of American Foresters, Washington, D. C., December 15, 1950.

we should give attention to the possibility of returning to the soil some of the vitality we have taken from it. It is not difficult to process wood so that it will be a soil conditioner. This can be done cheaply, and can fit into our present economic structure.

In the Teco laboratory we are able to convert a ton of wood into 1,600 pounds of soil conditioner. On the basis of our present information, this material is as good, if not better, than peat moss or other similar products. Incidentally, peat moss wholesale in many parts of the country for about $60 a ton.

Some of the test results on this converted wood are remarkable. A California firm in making four separate tests on onions found that the increase in weight of the onions grown in treated soil over those in untreated ground was 40 percent. Six tests were conducted on beets and the increase was 120 percent. When carrots were tried, the results were almost unbelievable; the increase in weight was 283 percent. Tomato plants set out in Washington in the summer were still producing fine vegetables in October, but similar plants in untreated soil wilted and died in September.

This is a fine achievement, but it is not enough. Equipment must be made and markets developed. To manufacture the soil conditioner, a plant of 20 tons daily capacity will probably cost $70,000, which is not a high price. However, the real development is still to come when portable equipment is available so that a plant can be moved from one sawdust heap to another. Perhaps we will have the ultimate when the farmer or woodlot owner can draw his waste wood into a compost heap, sprinkle it with chemical and then after a matter of weeks spread the converted material over his fields.

Fiber Products

Americans use millions of tons of fiber products each year. A large part of the raw material for making products, such as paper and hardboard, comes from young, vigorous trees. They are cut and used just at the time they are putting on the greatest growth. There is nothing wrong with this practice and the bulk of our fiber products will probably always come from such timber because it is cheap to grow and makes the best product. However, at sawmills and logging operations many thousands of tons of wood waste from old trees are burned or allowed to rot. New methods must and will be developed whereby this waste can be economically converted into wood pulp and other fiber products.

Several processes of this type have been developed in U.S. laboratories. In our own laboratory we have a process for the conversion of hardwood waste into a pulp suitable for hardboard, insulating board, corrugating board, or even low grade paper. The erection of production plants using this and other waste utilization processes seems assured.

On the West Coast a number of firms are producing hardboards from sawmill waste.

Sugar From Wood

In a small city in Oregon, a plant for the production of wood sugar and alcohol was erected in 1944. It was planned that this plant and other plants to be erected would use hundreds of tons of waste wood available from the many sawmills in the region. Partly because of technical failures that could have been overcome by experience, but principally because of unforeseen adverse economic conditions, this plant did not come into production as planned. According to the latest reports, however, molasses is now being made on a limited scale and when conditions justify, the equipment can be used for the purpose for which it was built. But optimum development can come when markets for the waste lignin are developed.

Lignin

About one-third of all wood is composed of lignin. It is the natural adhesive that holds the fibers together and contributes to the strength of wood. It is important to the paper manufacturer or to others going into the production of wood sugar, principally because of the difficulty of getting rid of it.

Some experimentation has been conducted on lignin. Probably one of the first developments to become popular was the conversion of lignin to vanilin, but the potential utilization of lignin for this purpose is very limited. Lignin has also been used for road binding materials and as a purifier to collect silver from spent photographic liquors.

Lignin has great potentials. It can probably be made into adhesives and coatings for metals or wood. It can be developed into charcoal-like products to be used in the purification of industrial waters or for filtering chemicals. It is suspected that lignin might be used to produce certain chemicals, such as phenols, or even for medicinal ingredients.

The field for the investigation of lignin is wide open and it is to be hoped if not anticipated that many research organizations will soon be so employed.

Destructive Distillation

The chemicals that can be obtained from wood are legion. Some modern methods are being successfully used for destructive distillation. Perhaps with a modest amount of additional work, other new refinements of distillation methods will yield still further satisfactory results. If one wants to delve into the mysteries of wood, it would be well to consider the production of acetylene. As a matter of fact, one of our clients is already studying a preliminary proposal on such a process.

Glues and plastics can be made from wood, but of more immediate importance is the development of new glues regardless of their sources. In the past 15 years considerable progress has been made. We now have intermediate temperature, fully waterproof glues that will endure practically any condition. We have fine water resistant glues that will cure rapidly at room temperatures. Added to these advances are the new methods for curing glues by high frequency equip-

ment and chemical catalysts. Probably few people realize what modern glues have accomplished for the wood products industries, nor is it realized how much we need even better glues.

The Importance of Laminating

From second-growth timber we must make big ones out of little ones. We need to be able to glue 4-inch boards together to 8-inch boards, but of course this has to be accomplished economically, and the 8-inch edge-glued boards must be serviceable either indoor or outdoors. No glues now available will permit this to be done with the efficiency desired.

We need new cheap clamping methods for glue laminating. Attainment of these objectives should not be difficult. Advancement can be expected along these lines in the not distant future.

Probably the thing that is needed most in the field of technical development of wood is some way to prevent it from shrinking and swelling. Some work has been done, and some remarkable results have been obtained. For example, there are water repellents that will do a good job for certain uses. There are moisture resistant coatings that can be depended upon to protect wood for some services.

An example of the beneficial use of water repellents is in the protection of desk and household furniture drawers. A good repellent will retard the rapid absorption of moisture to such an extent that the drawers in furniture will not swell and bind. The efficiency of water repellents for a short time is quite high, but after a prolonged period of exposure, efficiency disappears or is greatly reduced. Fortunately in many instances the conditions of exposure alternate back and forth to such an extent that repellents provide all the protection needed.

Coatings to Prevent Shrinking and Swelling

An example of the beneficial use of coatings can be found in the recent process developed by the Timber Engineering Company laboratory for protecting shoe lasts against moisture absorption. Shoes are always made over a wooden last. Sometimes wet leather is tacked to the last and then pounded and dried to the proper shape. If a last expands to any appreciable extent, the shoes which are shaped over it may vary from each other as much as one size. We have found that the best waterproof coatings provide all the protection necessary for shoe lasts. In the last year, the practice of coating shoe lasts with a good protective material has developed rapidly.

We need processes for cheaply treating lumber so as to prevent shrinking and swelling when the lumber is exposed for long periods. In our own laboratory we have been working with methods of impregnating chemicals by sonic treatments. We have obtained encouraging results. However, the investigations are in their infancy. The problem is of so much importance that many research organizations could be beneficially employed in solving it. Unfortunately, this is the type of investigation that is very difficult to conduct, and working on it costs a great deal of money. Most organizations prefer to spend their funds on projects that provide quicker results.

Kiln-Drying

New methods for kiln-drying are urgently needed. Until a year or so ago it did not seem likely that much could be done to hasten or improve the methods for drying over those which were adopted about 1918. High frequency drying with electronic equipment was considered to hold certain promises. But for quantity production at the sawmill or furniture plant, it appears that obtaining energy for drying by means of high frequency is much too expensive.

A new theory of drying by using standard equipment was proposed by the Moore Dry Kiln Company, and later by the Forest Products Laboratory. In our own laboratory we have tested these theories and find that they work. For example, with the usual method of drying, it is customary to have a high humidity and a low temperature. The gradation of these conditions has to be uniform throughout the schedule. It has now been found that lumber of high moisture content if properly handled can be dried at a low relative humidity and that after it reaches a certain stage in drying, the temperatures can be increased far beyond anything that was formerly thought to be practical.

However, much work remains to be done on this method of kiln-drying, and after the laboratory research is completed, putting the knowledge into practice will be the second difficult job. It is reasonable to predict that in the near future the wood-using industry will benefit from the research work that is now under way.

Lumber Grades

The lumber industry has developed a fine system for grading lumber. Of necessity the rules are intricate and can be interpreted and applied only by persons who have had considerable experience. The development of structural stress grades whereby timbers could be graded in accordance with their strength properties was a tremendous step in making lumber an adequate material for engineering purposes.

In the hardwood industry No. 2 Common and lower grades of lumber usually go begging for markets during depressed economic periods. This isn't because No. 2 Common hardwood lumber is of no value, but because for many fabricating plants it does not pay to transport lumber that contains large percentages of unusable materials. Air dried hardwood lumber probably averages 3,000 pounds per thousand board feet. For ordinary uses in furniture plants, etc., the utility of No. 2 Common boards probably averages 50 percent, or the actual material used weighs only 1,500 pounds. Hence the products manufacturer, if he uses No. 2 Common hardwood lumber in accordance with the usual prac-

tice, has to pay a relatively high freight bill.

In the Teco laboratory we have worked on a project for approximately three years, the objective of which is to develop a new grade of lumber made from No. 2 Common boards in which most of the unusable portions have been left at the sawmill or concentration yard. This new material we call Milpak. This same idea if carried a little further can probably be used for other grades of hardwood lumber. This type of development in combination with modern laminating will be two of the things that will make the trees of our second growth forests of maximum value.

Other Developments

The list of things which will develop from our wood research laboratories is indeed lengthy. For example, we will learn much more about the strength of wood. We will learn what happens to wood when it is subjected to high temperatures or to very low temperatures. We will learn much more about changing the properties of wood to make it stronger, resistant to shrinking and swelling, etc. We will set up improved test procedures for quality control in the wood products plant.

For example, we now know that it is possible to use sonic vibrations to determine the modules of elasticity. Equipment for this purpose can be easily and cheaply made. It is not too much to expect that through its use the manufacturer of wood ladders can immediately detect any piece of material that is low in strength. The manufacturer of structural lumber will be able to determine whether there are hidden knots or other defects, and the plywood producer can tell when there is a faulty glue line. Testing procedure of this type can be automatic and organized so that the equipment can be installed any place in the production line.

New materials for decay prevention, fire resistance, coloring of wood, and protection against insects are in the making. Portable equipment for manufacturing wood wastes into raw material for the pulp mills, the chemical plants, and for other purposes will be developed. Such equipment will probably be designed to be transported from one mill site to another.

We will learn much more about finishes. For example, even the finest pieces of furniture, no matter how well finished, may show signs of surface checking. The reasons for this are not well understood but they are being studied, and when the causes are known, the remedy should not be too difficult to develop. Our technical organizations are competent to deal with the situation.

It is the present mode to use much blond furniture. The finishes or the wood darken with age. Modern chemistry can cure this trouble. The principal problem is not whether the job can be done, but whether it is economical to do it.

Several research organizations are working on new types of fasteners. For example, the Timber Engineering Company is chiefly responsible for the successful development and use of the split ring connector. The Trip-L-Grip connector and many other items have made it possible to use structural lumber to better advantage. New types of furniture connectors, including glues, are in the laboratories. New metals are being used for screws, nails, etc. Methods for compressing or expanding wood tenons and dowels are in use and will be improved upon. In the future we will learn much more about adequate methods for joining wood and steel.

In the manufacture of furniture, boats, and other items, bent wood is an important raw material. Not much is known as to why wood bends under certain conditions or why it does not bend under others. Not much has been done to improve these properties, but today there are laboratory investigations under way which will be helpful. For example, it was only recently that we learned that laminated wood could be steam-bent equally as well as solid wood. Further work must be done in this field, but when the problems are fully investigated it will mean that small clear pieces of material can be glued together and then steam-bent. It will then be unnecessary to place so much dependence on large clear pieces of material.

In wood furniture manufacturing many new developments can be expected. Combinations of wood with other materials are being studied. We need research to develop means whereby wood can be better adapted to production lines. When this is done, one of the chief advantages of competing materials will be eliminated. We need new finishes that are heat- and moisture-resistant. The new type cigarette-proof tops for furniture developed in the Teco laboratory and processes developed by others are steps in the right direction. Hardened furniture parts for pianos, desks, and other furniture should be developed. The new process for hardening desk legs is now in use.

The development of new types of wood containers for liquids will expand the uses of wood in the cooperage field. Containers for holding gasoline, other petroleum products, or acids are being devised.

Use of the X-ray to look into a piece of wood will prove helpful in determining many things such as the beauty of the grain, whether there are foreign materials embedded in the wood, and perhaps it will show up other things that can be seen in no other way.

We need new types of chippers for producing raw material for pulp, wood sugar, and other items. An urgently needed development is in equipment to remove bark more economically than can now be accomplished.

The lumber and wood-using industry has long needed new developments in machine equipment. The present type of saw chews up many thousand feet of lumber annually. Thinner gage saws or other new machinery for cutting down waste are being studied and will gradually be developed. Recently

in our own laboratory we tested a German saw that, in general, required less than 50 percent of the power needed for the conventional saw; also it was found to be much safer to use.

The railroads annually replace 50 million wood ties. Most of this loss is caused by mechanical wear. In our own laboratory we are working on the problem and believe that the service life of a tie can be improved. Laminating of ties is not beyond the realm of possibility. Treating a tie for the prevention of decay and drying it at the same time will be of tremendous importance to the railroads. This is now being accomplished in the laboratory. Prevention of splitting of ties when they are in use is also extremely important. Important steps in solving this problem have already been made.

New methods for heating homes are being developed. Radiant heating is an established practice in some sections of the country. Work is in progress at some of our laboratories to determine the effect of this type of heating on hardwood flooring and on the mastic which is now generally used in laying block flooring. If it is found that there is deterioration in the wood or mastic, then the remedy will be found and applied.

In the field of packaging it can be anticipated that tremendous strides will be made in the future. Lumber will not be handled board by board but will be transferred from one place to another in large compact packages.

The Human Factor

Emphasis has been placed on the technical development of wood products. Most of the things cited will eventually go into production. There are many other fields of research. For the past six years a publication known as the *Forest Products Research Guide* has been published by the National Lumber Manufacturers Association. It contains thousands of suggestions with respect to these fields of research. It also tells where research is being done.

However, the most important test tube potential, the training of technical people, has not been mentioned. One of the chief reasons for our lack of technical progress in the lumber and wood products field is that we have not sufficiently encouraged wood technologists, engineers, and chemists to provide the knowledge which the industry needs. As a matter of fact, we have too often shunned the services of these people.

Thirty-five years ago the employment of a management forester by industry was a rare thing. Our forestry schools in those days depended upon the U. S. Forest Service and the state forest services as the only opportunities for technical employment. Technologists in the field of wood utilization were practically unknown and the student of those days had little to look forward to unless he was lucky enough to find employment in a government agency.

It is with pride that we industry foresters can point to the fact that today hundreds of foresters are employed by industry in the field of forest management. Other hundreds are engaged in positions concerned with wood utilization. Our forestry schools in 1951 will probably place more foresters in private industry than with government.

This movement from the schools to the woods and manufacturing plants is the greatest test tube potential available to the industry today. Any wood research laboratory, whether it be public or private, will benefit greatly by keeping in touch with the nation's forestry schools. Help should be given the staffs of the universities to design their courses so as to provide the best possible training for the young men we need so urgently. No industry can progress without new blood; no industry can progress without change; and no industry can progress without the constant development of new technical processes.

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Junior Agricultural Assistant Examination Announced

The U. S. Civil Service Commission has announced new Junior Agricultural Assistant examination which covers positions in various agricultural fields. The entrance salary is $3,100 a year. The majority of positions to be filled are located in the Department of Agriculture and the Department of the Interior in Washington, D. C., and throughout the United States.

To qualify, applicants must pass a written test. In addition, they must have completed a 4-year college course leading to a bachelor's degree in the optional field for which they apply. They may also qualify on the basis of a combination of pertinent college study and appropriate experience totaling 4 years. Students who expect to complete their courses by June 30, 1952 may apply. The age limits, waived for persons entitled to veteran preference, are from 18 to 35 years.

Information regarding the examination and application forms can be obtained at most first- and second-class post offices, from civil service regional offices, or direct from the U. S. Civil Service Commission, Washington 25, D. C. Applications must be received not later than Oct. 23, 1951.

Looking Ahead in Range Reseeding[1]

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RANGE RESEEDING has been found by research studies to be a highly satisfactory means of increasing range forage and improving soil stability and watershed efficiency. The urgent need for silt control in the Colorado River drainage basin has given rise to a discussion of what range reseeding can contribute toward reducing sedimentation. To accomplish this end a large action program is required. For the worst areas, reseeding is the only feasible management method of achieving control in a reasonable period. Since information on which to base such a program is woefully deficient, research must first advance the frontier of knowledge before large action expenditures can be justified.

The relationship between research and the application of research findings in the subsequent action program may be set forth by a short history of the early phases of range reseeding in the Intermountain region. In 1934 and 1935 several series of preliminary broadcast seedings in the sagebrush-cheatgrass zone showed that it was necessary to remove the natural vegetation and to cover the seeds with soil.

After an analysis of problems and conditions, it was decided that the sagebrush zone presented the greatest need and at the same time offered the greatest opportunity for range reseeding. It was also determined that research should later be done in mountain brush, after that in the higher mountain zones, and finally in the desert shrub zone.

The first studies of range reseeding consisted of species adaptability tests, in some cases plowing out sagebrush with a moldboard plow and in other cases grubbing it off by hand. The studies later grew to include systematic collection and testing of species and strains of species; comparative studies of the value and methods of brush removal; how, when, and where to plant; and what are the site values involved. The findings derived from these studies permitted the development in 1943 of a program for action reseeding in the sagebrush zone and in a more limited way in the mountain brush zone. Two studies on utilizing reseeded ranges with cattle are in progress. The investigative program is now in full swing in the aspen-fir and in subalpine zones. In the juniper and salt-desert shrub zones, the first seeding studies are just being conducted and more complete ones are contemplated. Seeding on fair to good soils has been stressed to get high forage production. The demand for recommended species and procedures on poor soils and under favorable climatic conditions has become urgent in order to help in revegetating damaged watersheds and for silt control in the Colorado drainage basin.

Present Program of Action Reseeding

Meantime, action seeding by the U. S. Forest Service in the Intermountain region is rather advanced in the sagebrush zone so far as funds are available and so far as large areas of sagebrush suitable for reseeding occur on the national forests. Urgency of protecting watersheds has led to seeding on some areas for which the research background is inadequate. Some failures and partial failures have resulted from this cause.

The Bureau of Land Management has an action program, but it is inadequate in proportion to the needs of its vast area. The Bureau has expended considerable funds ear-marked by Congress for airplane pellet seeding, much of it resulting in failure. The Indian Service also has had similar bad experience with pellet seeding. A careful study by the Intermountain Station and regional office of the Forest Service has shown that soil pellets can be distributed effectively, but that stands of grass do not result from pellet seeding. On the other hand, recommended ground methods used in the same areas give good results. Plastic pellets need further investigation.

Private land owners have done considerable reseeding, but only a fraction of what their lands need. The percentage of failure on private land is much higher than necessary, largely because of the tendency of some private individuals to short-cut procedures recommended as a result of thorough research.

Range reseeding has in the past had a sound development because, in the main, action seeding has proceeded only on areas for which research has established the base. This paper attempts to outline expected developments in courses of action, research effort, and resulting trends. The discussion is divided into three time periods: (1) the immediate future, i.e., the next 5 years; (2) the following 10-year period, 5 to 15 years from now; and (3) predicting the general course for the period beyond 15 years. Effort according to time periods will vary from region to region.

The Immediate Future in Range Reseeding

The course that research and action programs in range reseeding will take in the next 5 years can be forecast at least in part with considerable accuracy. Movements in range reseeding that are already fairly well developed are likely to continue for this length of time:

1.—Effort to revegetate critical watersheds that now bear a damaged plant cover will continue for some years and is likely to be strengthened and to be made wider in scope.

2.—A course of action not as yet so well developed, but well started and likely to grow in scope and intensity is revegetation for silt control in the Colorado Basin.

[1]Paper presented at a meeting of the Division of Range Management, Society of American Foresters, Washington, D. C., December 15, 1950.

3.—A third development will probably be the application by stockmen of more and more pressure on federal and state agencies for reseeding ranges on national forest and Bureau of Land Management lands.

4.—Already a hitherto imperceptible tide of opinion is beginning to swell up that stockmen should on their own account start a reseeding program on private land. Many businessmen think stockmen should also aid the program for reseeding on public land over which their livestock graze.

5.—The intimately related economic tendency to make reseeding a good business enterprise seems to me has unmistakably begun and is likely to grow into a force of some size.

6.—In the immediate future the suitability of species and methods of removing competition from high altitude areas require vigorous attack. The heavier and more adjustable machinery that will be required for larger brush and rocky lands, and fuller use of fire and chemicals must be considered rather thoroughly. Studies on sagebrush and rabbitbrush types will continue as part of the search for more complete and less costly eradication and for still more suitable species.

Trends 5 to 15 Years Hence

Those currents now moving or which exist only as drifts are likely to continue through the next few years and run into the period 5 to 15 years hence.

1.—Interest in strains of forage species is bound to continue and in 5 to 15 years is likely to be one of the most intensive efforts.

2.—Working with naturally poor soils and those much damaged by erosion is not likely to be delayed more than a few years.

3.—Steep and rocky sites are sure to demand attention.

4.—It seems likely that developing a means of judging sites and forecasting their potential productivity is certain to be investigated.

We can no longer hope for large numbers of new grass species unless there are species introductions from collecting expeditions that now seem unlikely. We must, therefore, look over the hopeful species more closely and give the search for strain selections and hybrid segregates a much higher priority than it now has. Extension of reseeding to drier areas and salty sites points clearly to the great need of studying a considerable series of shrubby species for browse forage. Browse in more favorable areas will also demand attention for big game forage. During this period grazing management of reseeded ranges will be more adequately investigated, but the study will have to extend into the period beyond 15 years.

The demand for means of silt control in the Colorado drainage basin calls directly for finding species suitable for areas where silt movement is high. These are mostly in areas with annual precipitation below 10 inches, where soils are either excessively sandy or heavy and strongly saline. Three special studies, perhaps more, will be required of Research to meet this situation. These are: (1) determining which of the species that can grow with such small amounts of precipitation are suitable for the soil types of the Colorado Basin; (2) assessing methods of removing plant cover, preparing the soil, and seeding; and (3) determining the management required to perpetuate seeded stands once they are obtained. It will also have to be determined whether it is economically feasible to apply fertilizer and if so, which soils require fertilizer, what kind, and in what amounts.

A study has just been started and it should be continued if necessary into the second period to determine how to control sagebrush, rabbitbrush, and mountain brush in seeded stands. Burning, 2,4-D and the corn stalk beater should be tried thoroughly, so that their relative effectiveness, cost, and feasibility may be determined.

Investigations will be required on extremely dry and on badly eroded sites, such as the desert-shrub zone, regarding the selection of species and strains of plants that are most suitable, what are the most practical methods of removing native cover without severe soil disturbance and of seeding, and what is required in the way of subsequent management. Saline soils occur commonly in the areas of very low precipitation. Both species and methods for getting successful seeded stands on such sites have as yet received only the most meager attention. How to remove pinyons and junipers and mesquite may involve new types of machines or new departures in use of fire or chemicals. Methods of reseeding in conifer fringes and determining suitable species will be important studies in several areas. Also, providing seed sources for new species and new strains must be accomplished.

Collecting legumes on an exhaustive basis and determining how they can be satisfactorily used in range reseeding, seems to me an inevitable undertaking for the period between 5 and 15 years from now.

An exhaustive search for low-cost methods that are at the same time definitely more effective than we now use must be undertaken. This is likely to mean, among other things, a straight-forward and vigorous effort to harness fire as a tool for removing brush and small trees.

Predicting Developments for 15 Years and Later

Ultimate developments are clearly too far away to forecast except on the strength of really basic trends, and assuming that many early efforts will continue in this period. I am going to venture two predictions—one for research and one for administration.

1.—Future studies will show that good native cover (mixed shrubs, forbs, and grasses) can profitably be replaced by seeded species with returns about double the present yields of forage. It will probably be found necessary to retain half or more than half of our native cover to supplement the low protein and vitamin content of grasses after maturity. Nutritional needs will most likely receive more attention with time, knowledge,

and use of the land. The feeding of mineral and other prepared supplements is likely to require much study.

2.—Eventually, with increasing population and decreasing land areas used for growing livestock roughage, intelligent public opinion will promote, then urge, and finally demand that a revegetation program be put on a western-wide scale adequate to get the job done.

Report of the Committee on Forest Management, Allegheny Section, Society of American Foresters, February 1951

This committee was asked to assemble information on the problem of low-grade hardwoods. Our report discusses (1) the problem and (2) present knowledge on handling the problem.

What Are Low-Grade Hardwoods

The convenient term, "low-grade hardwoods," includes all hardwoods that are of little or no value when compared to the possible forest growth on the different sites. Thus, low-grade hardwoods include both the hardwoods that are unprofitable trees on any site and those hardwoods that, while highly desirable on certain sites, are far less valuable than other species on the sites with which we are concerned. Examples of tree species that are considered to be always unprofitable are pin cherry, dogwood, blackgum, silver maple, and sweetbay. Examples of hardwoods that are sometimes highly desirable and at other times a problem are sugar maple, most of the oaks, and sweetgum.

Why Low-Grade Hardwoods Are a Problem

There are several reasons why low-grade hardwoods are usually a problem—at least to those persons interested in growing the best timber crops possible on their forest lands.

Limitations in Ecological and Silvicultural Knowledge

The forestry profession is so young in this country, and for such a short time has made any appreciable attempt at managing forest lands, that limitations in our ecological and silvicultural knowledge still form a serious handicap.

For example, in the Delaware Valley section of southern New Jersey are moist fertile soils where pin oak, northern red oak, water oak, basket oak, yellowpoplar, sweetgum, and other valuable species develop high-producing stands. The site index at 50 years is frequently 80 to 85 feet. While some of the harvest cuttings marked by foresters have favored reproduction of desirable species, too often rank herbaceous growth (6 to 10 feet tall), thickets of sweet pepperbush, or other thickets of red maple and dogwood have developed. To the best knowledge of local practicing foresters, there is practically no information on the successional stages on these sites or on the necessary silvicultural measures to favor the desired species.

Another illustration concerns thinnings in Atlantic or southern whitecedar stands. Between 1846 and 1931 several authors recommended thinnings in these stands, most of them without ever having done any. Beginning in 1921, New Jersey foresters made thinnings in these stands, and the initial results were pleasing. Windthrow was not excessive, and although costs ran from $200 to $300 an acre, profits during one 5-year period averaged $56 an acre. However, by 1938 it was realized that the thinnings greatly favored the development of dense shrubby understories along with reproduction of red maple, blackgum, and sweetbay — trees that are usually worthless on these sites. Furthermore, thinnings did not greatly increase the growth of crop trees, and volumes available for harvest cutting are usually reduced. Consequently, most foresters in that section now do not believe in thinning whitecedar stands, although perhaps their present belief is not the final answer.

The preceding illustrations are not unique, but common to most of you who have had to apply management on the ground in specific tracts. Our knowledge is still so incomplete, and sites and stand compositions vary so much within small sections, that usually our management recommendations to woodland owners cannot be guaranteed to give the best possible results.

However, the present status of our knowledge is just what might be expected. If 40 to 100 years are required to grow a crop, we just cannot get all the answers in a few years; several years may be required before results are apparent, and even more before they are generally recognized.

Limitations in Utilization

Even if we knew all the answers in the ecology and silviculture of our forests, low-grade hardwoods would still be a problem from the standpoint of limitations in our utilization. In the first place, not all species have the same form, produce the same quality of wood, and have the same growth potential on a site. Because we (1) harvest trees for specific uses, (2) have little use for defective wood, and (3) find woods of high quality, large size, and long lengths the most satisfactory to use, owners naturally receive far more for trees

furnishing high-quality material than for those of lower grade.

Secondly, there are very great sectional differences in the markets, particularly for low-grade hardwoods. For example, low-grade but sound hardwoods can be marketed for feltwood in southern New Jersey, but not in northern New Jersey. There is a market for furnace poles in northern New Jersey, none in southern New Jersey. In middle and upper-class suburbs there is usually a market for fireplace wood, but perhaps 15 miles away in a mill town there is little or no such market. Then, too, our other markets—as for mine props—are often localized. What we need, of course, is a market for most sizes and species if we are to practice intensive forest management, and in many sections there is no such market.

Past utilization is another factor that has produced the problem of low-grade hardwoods. Some of our woods have been cut repeatedly under a system of "loggers' choice," and—while admitting the economic necessity of most such past actions—this committee believes that past cuttings have greatly aggravated our problem. If white oak is the most valuable species in a mixed hardwood forest, its proportion of the stand cannot be maintained or increased by harvesting only white oaks!

Limitations Arising from the Owners

The hard facts of available markets are not the only problem in economics faced by practicing foresters. They also have to consider the owner's economic standing and also his attitude toward his woods.

In brief, consulting and farm foresters alike find that owners tend to fall into four groups. These are: (1) The very few who will invest an appreciable amount of money or effort in their woods—either because of their love of the woods or because the expense reduces their income tax; (2) a larger number who will invest some slight effort or money, particularly if any expense can be paid from present income or will provide returns during the owner's lifetime; (3) an appreciable number who, though interested, cannot afford the effort or expense; and (4) those who—regardless of expected benefits—would not heed a forester's advice.

Because practicing foresters are limited by the economic standing and attitude of owners, they usually cannot apply the exact treatment that they believe the forests need. Instead, the treatments are a compromise, and there are all gradations in this.

However, it should be recognized that the efforts of practicing foresters can be most productive if they can capture control of large existing markets. Such market control can be used by foresters in persuading presently uninterested owners or operators to follow forestry practices.

Methods of Controlling Low-Grade Hardwoods

Let us consider the methods by which we might solve the problem of low-grade hardwoods—if we could get them applied. There are three general methods that are applicable in varying degree throughout the Section. They are (1) the use of chemicals to kill undesirable hardwoods, (2) the use of hand or power tools in girdling undesirable trees or in cleanings, and (3) the use of commercial cuttings, either intermediate or harvest cuttings. Two more methods are seemingly limited for the most part to application in our pine-hardwood stands. They are (1) the use of machinery and (2) the use of fire.

Role and Limitation of Each Method

Chemicals.—The use of chemicals is a relatively recent development. Two of the most promising are Ammate and a combination of 2,4-D and 2,4,5-T. The chemicals may be applied in varying ways. Ammate may be used as a salt on fresh cuts (i.e., stumps or cups in standing trees), or in water solution as a foliage spray on reproduction. The combination of 2,4-D and 2,4,5-T is used in liquid form, usually in a kerosene or Diesel oil solution, and this may be sprayed on stumps, the basal portions of large trees, or the foliage of reproduction.

Results from using these chemicals may vary greatly. The species treated, amounts used, methods of application, and other factors greatly affect results. In addition, where sprays are used, damage to interspersed desired trees can be expected.

Perhaps the biggest advantage that the proper use of chemicals offers is the possibility of obtaining very decided results by a single application.

Although the use of chemicals is so recent that their role is not well defined, their cost is a factor that will probably greatly limit their use in forest management, perhaps to a minor role. For example, in using Ammate, foliage sprays tend to be the most expensive, treating standing trees with crystals in in cups less expensive, and placing Ammate crystals on freshly cut stumps the least expensive. Yet in pine-oak stands where there are only 540 oaks 1 to 6 inches d.b.h. per acre, and where these hardwoods can be sold, the cost of materials and labor for placing Ammate on the stumps would be about $10 an acre at 1950 prices. For other uses of chemicals, costs of $60 an acre are not uncommon.

Hand or power tools.—Because of the cost of chemical treatments, considerable reliance will probably still be placed on the use of hand or power tools, both in cleanings and in girdling, to release reproduction. Such use of hand tools still provides the cheapest way of shaping stand composition in many reproduction stands. For example, an expenditure of $2 to $4 an acre may change the composition from one dominated by red maple and dogwood to oak and yellowpoplar.

Such release work has not been extensively applied to date, and there is a definite need for information on just where and how the work should be done to give satisfactory results. Power tools that might reduce the cost of this work should be tested.

Release cuttings should not be the sole reliance in areas where reproduction of desired species may be slow in becoming established. For example, in pine-hardwood

stands where advance reproduction or sprouting stumps of undesired hardwoods are present, several costly cleanings may be needed if prompt or advance reproduction of pine has not been secured. Hence, the first consideration should be in providing prompt restocking of cut-over areas.

Commercial cuttings.—Commercial cutting, as herein used, implies the profitable cutting of products for sale or home use either by operators or the owners. Commercial harvest cuttings should be shaped to provide abundant reproduction of the desired species. Too little is now known about the effect of different types of harvest cutting, but all available information does show that within two-score years man may almost eliminate or greatly favor the desired species.

Improvement cuttings, where commercially possible, can greatly modify stand composition, particularly in the mixed-hardwood forests. Both types of commercial cutting form the first step in solving the problem of low-grade hardwoods, and should be utilized to the fullest extent possible both because they prevent unnecessary expense to the owner and because they would be applied by more owners than would methods entailing some expense.

However, if commercial cuttings are to have the desired effects, good markets are required for relatively low-grade, small-size material—as for feltwood, mine props, furnace poles, fuelwood, or chips. In this respect expansions in the feltwood market have been encouraging, as has the development of interest in portable chippers to supply bedding, mulch, and organic matter for agricultural soils.

The availability of these markets varies greatly, but sometimes foresters can encourage the use of unwanted species by certain industries where their requirements can be met. For example, the use of beech in the mining industry of southern West Virginia has thus been stimulated.

Where good markets are available, they are a two-edged sword. Unless cuttings are properly handled, operators may use high-quality poles for furnace poles or feltwood; stand composition may deteriorate from improper cuttings; and the problem of low-quality hardwoods may be aggravated, not lessened.

Machinery.—In the pine-hardwood stands machinery may be used (1) to favor the establishment of pine reproduction through exposure of mineral soil, and (2) to retard the development of hardwoods. The machines most suitable for this work are heavy disks, disc-type plows, and bulldozers. Usually this use of machinery requires treatment after heavy harvest cuttings, because in most stands there is difficulty in maneuvering the machines between trees. Consequently, the best results seem to be obtained when treatments are made after cutting, but within a few months prior to the fall of heavy seed crops. Some areas in southern New Jersey where treatments had been made in poor seed years were very slowly restocked, 7 years or more being required.

The extent to which hardwoods are controlled depends on the type of machinery used, the thoroughness of the coverage, and the size of the hardwoods. Disks tend to ride, rather than uproot, stumps and trees. Consequently, where large hardwoods have been cut, disking reduces only slightly the number of sprouts. Bulldozing is far more effective, but unless excessive time is spent, even on bulldozed areas there may be appreciable sprouting of hardwood stumps or trees that were not removed or were only transplanted. Of course the more thorough and severe the treatment, the more any advance reproduction of pine is eliminated.

The use of machinery is hampered by rough terrain and rocks. Bulldozing is, in addition, retarded in areas where relatively small sprouts from large stools are the problem, because they provide far less leverage than single stems. The effect of using machinery on the site, its water relations, and erosion varies, and little information thereon is available. However, these effects are doubtless more important inland than on the coastal plain. On the whole, the use of machinery does not seem to be widely applicable. Hardly any owners have suitable equipment on hand, and only the very largest owners would purchase it. While, under favorable circumstances, the cost of a single treatment might be $5 to $10 an acre, for most owners the cost would be more.

Fire.—Two uses of fire are possible, in some forest stands. One is the use of fire only at the end of the rotation; the other, the use of periodic light fires under the stands after the trees have developed to a size where they are resistant to damage.

At the present time the recommended use of fire is confined to pine-hardwood stands of the coastal plain, although ecological studies have indicated that certain past fires have favored the development of our more inland pine stands. However, there is no information on the planned use of fire in managing for such stands—either on the effect on stand composition or the effect on site and water relations.

Observations indicate that occasional fires might also be advantageously employed in certain hardwood stands, as in seedbed preparation for certain pioneer species—but again no attempts at using them have been made.

More definite information is available on the use of fire in the pine-hardwood stands of the coastal plain. There it is possible to indicate the relative advantages and limitations of using fire only at the end of the rotation and periodically in stands beyond the reproduction stage.

One relatively hot fire at the end of the rotation may produce decidedly favorable results under certain conditions. First, an abundance of pine seed must be available for restocking the burn, preferably just after the fire. Secondly, any low-grade hardwoods occupying the area before the burn should be so affected that the pine reproduction can outgrow them. This is possible (1) if the hard-

woods are scrub oaks, or (2) if the hardwoods fail to sprout as when the area is low so that the fire burned into a very deep duff, or (3) if hardwoods are killed back, pine seedlings start at the same time as hardwood sprouts, and the pines have a very rapid initial rate of growth—as does loblolly pine.

However, even summer burns of logging slash in loblolly pine stands cannot usually be relied on to reproduce pure pine stands, even when heavy supplies of seed are shed on the burn that fall. Usually some cleanings will be necessary.

Reliance on heavy seed crops, as is necessary with the use of machinery or fire only at the end of the rotation, is not necessary when periodic fires are used during much of the rotation. These keep the seedbed so favorable that many pine seedlings start, particularly if thinnings or a shelterwood cutting has also favored their establishment. Consequently, with their use it is possible to have advance reproduction available whenever final harvest cuttings are made. This advance reproduction, even though only 0.5 to 3.0 feet tall is of course better able to compete with the hardwoods than seedlings starting after the final harvest cuttings.

The light fires used during a rotation do not control all hardwood growth, particularly in areas where the hardwoods are large enough to be resistant. But, because the effect on both hardwoods and the establishment of pine reproduction is cumulative, the more burns and the longer period they are used, the better are the results. However, in many areas cleanings are also needed if pure pine stands are to be developed.

The use of fire requires, of course, careful plans and trained crews, but it does have definite advantages. It is relatively cheap, costing usually less than $2 an acre during a rotation. When used during the rotation, it reduces the fuel available for wild fires and thus the chance of damage from such fires. In an area like the pine region of southern New Jersey, that effect alone is sufficient to promote its use by many owners who would not use such other methods as machinery.

A Combination of Methods

As the preceding statements indicate, not one of the methods by itself forms the complete answer. Usually in hardwood stands a combination of at least proper harvest cuttings and cleanings is necessary; in pine-hardwood stands some such combination as the use of fire, proper harvest cuttings, and cleanings where needed is necessary for the best results. The extent to which such combinations can be applied varies with markets and owner interest.

Where We Stand Today

Since the inception of forestry in this country, we have made appreciable progress in learning the ecology and silviculture of our species, in encouraging some practice of forest management by most classes of owners, and in helping to obtain better utilization of our forest crops. But we have still only started to solve the problems. Much still needs to be learned about the ecology of our species and about the best and cheapest ways of managing our stands, and we have only started to get management applied in our woods. The extent to which this can be done, and the best methods of doing it vary with locality, but in none should we be complacent about our present position. The best united efforts of all of us are needed.

William C. Bramble
Allen W. Goodspeed
Arthur C. McIntyre
Albert B. Mickalitis
Glenn E. Smith
Carl Stravinski
John F. Tillinghast
Silas Little, *Chairman.*

What Loblollies Are Likely Cone Producers

In southern Arkansas, as in earlier observations in the southeastern United States, the size and past cone-production record of a loblolly pine appear to be the best clues as to whether it will make a good seed tree. Crown density, crown area, and tree age have not yet proved to be consistent indicators.

Current observations on 56 trees released from competition in 1949 find 44 of the trees bearing cones in 1951. The average is 77 cones per bearing tree, with a maximum of 581. Three-fourths of the trees larger than 11½ inches d.b.h. have twenty-five or more cones apiece, but this minimum has been attained by only one-sixth of the smaller trees. Of the trees that bore cones prior to 1949, 95 percent have some again this year; the average is 129 per bearing tree. Only 70 percent of the trees coneless prior to 1949 have cones now, and the average is only 37 per bearing tree.

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New Orleans, La.

Notes

A Tool for Applying Ammate Crystals

A tool which facilitates poisoning of trees with Ammate crystals has been developed for use on the Fayette Experiment Forest of the Alabama Agricultural Experiment Station.[1] The tool is simple in construction, easy and efficient in operation.

Essentially, the tool consists of a cylindrical chamber in which a tablespoonful of crystals is picked up and a plunger by which the crystals are pushed from the chamber into a previously chopped cup in the tree to be poisoned. The operator fills the chamber by ramming it into a bucket of crystals. He applies poison to the trees by depressing the plunger while holding the open end of the chamber directly in the chopped cup.

Ammate crystals tend to cohere when compressed, and they form a firm core in the chamber of the tool. The core can be broken and the crystals spread in the cup if the tool is slowly withdrawn while the plunger is being depressed.

TABLE 1.—TIME REQUIRED FOR APPLYING AMMATE CRYSTALS

Basis	Time required	
	Tool	Spoon
Number of cups	*Seconds*	*Seconds*
6[1]	17	35
8[2]	25	55
	Minutes	*Minutes*
181[3]	23	30

[1]In a single tree, 14 inches d.b.h.
[2]In a single tree, 18 inches d.b.h.
[3]In 61 trees scattered over ½ acre.

On the Fayette Forest, a three-man crew has proved efficient. One man with the tool and a 10-quart bucket of Ammate crystals follows two axemen who chop cups in the trees to be poisoned. The original handle of the bucket was replaced with a wire handle which extends about 2 feet above the bucket's rim. This change eliminates the necessity of stooping over to pick up the bucket and permits the operator to remain erect. The galvanized bottom of the bucket is reinforced with a ¾-inch wooden disk, which fits snugly and prevents the bottom from being knocked out by the repeated jabs of the tool as it is loaded.

Efficiency of the Tool

A field test was made to compare the efficiency of this tool with that of the conventional tablespoon for applying Ammate crystals to cups chopped at the root collars of trees. The results are given in Table 1. Use of the tool instead of a spoon effected a saving of one-half of the time for applying poison. The saving of the operator's time was one-fourth of the total time required for walking from tree to tree and applying the poison. An additional advantage of the tool was that practically no Ammate was wasted

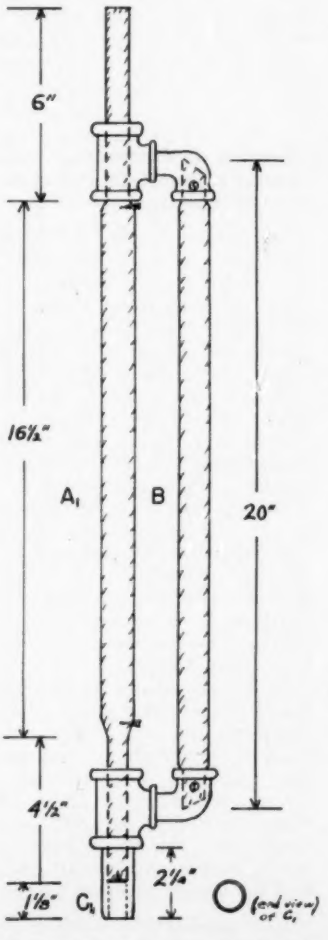

FIG. 1.—Plan for constructing Ammate tool.

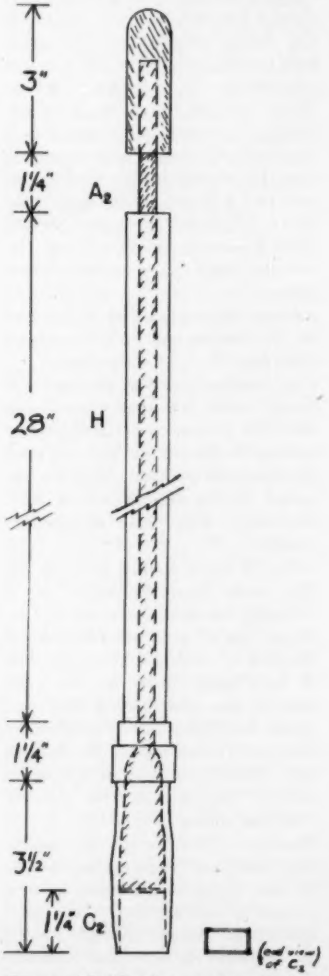

FIG. 2.—Modification of Ammate tool.

[1]The Fayette Experiment Forest is 56 road-miles north of Tuscaloosa, Ala. It is one of 8 experimental forests operated by the Forestry Department, Alabama Agricultural Experiment Station.

by spilling, which was often considerable when a spoon was used.

Construction of the Tool

The materials required for construction of the tool should cost less than $1.50. They are listed below:

1 broom handle, 20 inches long
1 broom handle, 27 inches long
1 section ¾-inch water pipe, threaded one end, 2½ inches long
2 tees, ¾ x ½ x ¾ inches
2 street elbows, ½ inch
3 flat-head screws, 1 inch No. 8
2 round-head screws, ¾ inch No. 8.
1 rubber disk, ¾ dia. ⅛ inch thick.

Each end of the 20-inch broom handle (brace) is trimmed to fit tightly into the open end of one of the street elbows. A 3/16-inch hole is drilled in each elbow to accommodate the holding screw. Each end of the 27-inch broom handle (plunger) is trimmed to a diameter of about ⅝ inch over a distance of 4½ inches at the bottom and 6 inches at the top. The ¾ by 2½-inch pipe (chamber) is slightly sharpened by filing the outside edge at the unthreaded end.

Next, the rubber disk is screwed to the bottom end of the plunger (A_1, Fig. 1). The chamber (C_1) is screwed into one of the tees. A street elbow is screwed into each tee. The plunger (A_1) is placed in position in the bottom and top tees. The ends of the brace (B) are inserted in the elbows, where they are held in place with round-head screws.

The plunger should be loose fitting so as to work freely. It is advisable to soak the lower end in oil so that it will not swell when the tool is washed. With the end of the plunger flush with the opening in the chamber, a flat-head screw is driven into the plunger adjacent to the top of the bottom tee. This screw acts as a stop to prevent the end of the plunger from extending beyond the end of chamber. With the plunger raised 1⅛ inches, a similar stop is put in the plunger adjacent to the bottom of the top tee. This position of the plunger leaves space in the chamber for a core of Ammate weighing 0.4 ounces, approximately equivalent to one tablespoonful.

Modification of the Original Model

A modified version of the tool has been made, which embodies refinements that eliminate certain disadvantages of the original model. The ¾-inch round opening in the chamber requires a rather wide cup to receive the crystals. The new model (Fig. 2) has an Ammate chamber of rectangular cross section, 0.45 to 0.90 inches, with a filling depth of 1.25 inches. This chamber is made by flattening and shaping a section of ¾-inch pipe.

The wooden plunger (A_2) operates through a ½-inch pipe, which serves as a handle. The wooden plunger head, or ejector, is stopped at the proper place on the up stroke by the shank of the reducer and on the down, or ejective, stroke by the wooden handle cap. The relatively flat opening of the chamber (C_2) makes it possible to insert poison into a cup considerably narrower than can be used with the round-chambered tool. Axe work in chopping cups is thereby reduced.

Additional advantages of the modified version over the original are its more compact design and its more rugged construction. It should withstand the abuse it is likely to receive when used by semi-skilled laborers. Its additional expense and the extra work of its construction are justified, if the tool is to be used on large-scale poisoning operations.

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Report of Progress, National Recreation Policies Committee[1]

The National Recreation Policies Committee, as now constituted, held its first meeting on April 27, 1949. Its origin traced to the belief held by many leaders in recreation and allied fields that a broad, representative professional interest group should be formed which would give continuing thought to recreation policies and to the leisure time problems of this country. Seven professional organizations sponsored the committee. In addition to the Society of American Foresters they include: American Association of Group Workers; American Camping Association; American Association of Health, Physical Education and Recreation; American Institute of Park Executives; and the National Conference of State Parks. Two appointees from each of those professional organizations comprise the committee. Members-at-large are also added to this group by committee election, and these are drawn from the broad fields of health, business and industry, natural and human resources, religion and education. The Society's appointees are Professor Shirley W. Allen, serving a four year term; and myself, serving a two year term.

The committee's function is mostly deliberative, and its statements with respect to recreation and leisure time recognize fully the differences between formulating major policies and the determination of them. It has no responsibility or authority for deciding policies in accordance with which recreation or leisure time programs are conducted. Nor does it replace or duplicate other organizations; to the contrary, it seeks to moblize and strengthen them. Statements made and actions taken are solely the responsibility of the committee; and do not commit any organization unless approved by its official body. Committee members serve as individuals and not as spokesmen of the organization from which appointed. In brief, the committee's structure is a cross section of several of the nation's interests in recreation and leisure time problems; and primarily its work is to identify these problems and state views most likely to aid in their solution.

If we begin as of its first called meeting in Washington, the committee is about one and one-half

[1]Paper presented at a meeting of the Division of Forest Recreation, Society of American Foresters, Washington, D. C., December 15, 1950.

years old. Since then, additional meetings have been held at New Orleans, Washington, and Cleveland. During this time a statement which defined its objectives and operations was developed and adopted. From a canvas of sponsoring agency members, a list of prospective members-at-large was developed, and these member additions elected. A constitution and by-laws are in preparation, and these will be acted upon shortly. A tentative listing of problems and projects characteristic of those to which the committee can best give its attention has been compiled. A selected group of universities will be canvassed for assistance through graduate study research on certain of these. Professor Allen has been active on this task, and, I might also add, in otherwise devoting much time and energy to the other work of the committee.

The committee chairman sent a letter to the armed services calling attention to the need of assuring an adequate leisure time recreation program and offering assistance in consideration of this need.

The high point of the committee's work thus far has been the preparation of the statement *A Mid-Century Declaration of Recreation Policies.*[2] This was prepared by the committee for use by the President's Mid-Century White House Conference on Children and Youth. It is being distributed to the sponsoring and other organizations with a request it be published and receive editorial comment.

You will find this declaration stimulating and thoughtful. It attempts an approach to a philosophy of recreation measured against the kind of time and age in which we now live. Also attempts to assay the needs and to form a broad framework around which these needs can be best met. As members of the Society you will find Item 2 in the list of important needs of particular interest. It reads: "Continued conservation of the natural resources of the nation, which may be utilized as one of their highest purposes for qualitative recreation for all the people. These resources include our forests, mountains, waterways, beaches, places of inspiring natural beauty, historic sites, and wildlife."

It is interesting to note and consider some of the circumstances which make this matter of recreation so increasingly important and that suggest close and continuous attention to this matter of leisure time. We are told, for example, that on the average a man today produces four to five times the manufacture output our fathers did in 1900; that the average work week of 59 hours in 1900 (often over 65 in many industries) is now 40 hours. Yet even though work hours were dropped 15 to 25 hours per week, we here in this country, having only 6 percent of the world's population, provided only a few percent less than half of the world's economic income in 1948. Our means of communications, energy development, distribution, and transportation have proceeded with breathtaking strides; and the demands for more, different and better means appear in no sense satisfied. It is a bit startling for many of us who have lived through much of the period to realize that in 1900 our census did not show an automobile industry, but featured the manufacture of 1.5 million buggies and wagons; and to contrast this with our present conditions where, despite war, economic and other vicissitudes we now find four out of every five families with automobiles. No matter where your eye or reading takes you, new, better, and greater quantities of energy, industry, products, materials, methods, and processes are noted. In all aspects of our life today we find frontiers and discoveries. Method, speed, and change seem apt descriptive words for this era. Our benefits have been beyond fond hope in lessening work and home drudgery. We are told, too, by the Bureau of Labor Statistics, that the real income per family between 1901 and 1948 has doubled, measured in 1948 dollar buying power. The family margin of income to spend for other than basic necessities has also changed from about one-sixth in 1900 to one-third in 1950.

Such data demonstrate the dynamics of this constant change which substitutes other kinds of work effort for human energy. The seers among the sciences say it is axiomatic that we are only at the beginning of this phenomena; that the new findings will be applied faster and that economic changes will probably be more dramatic than in the past. But — these sources hasten to state that the blessings are not unmixed. Our increased wealth means increased risk; some of our bed rock factors of security, as the home on the farm, with the large family and in the small community, are losing their place in the traditional American social scene. Only 15 percent of our nation's labor force is now engaged in agriculture, and this timeless security of attachment between a man and his farmland is falling, proportionately and absolutely. These sources describe a vast flux in population movement which by contrast makes pioneer population movements small indeed; and state that the population, in fact, is being characterized by its mobility. In these movements, we are reminded, the underlying motive is not to find a new farm or new residence; but to work in a new firm, or, to a surprising degree, in a new occupation. And among these negative matters the war threat must also be added to the list.

However, in all these changes, we now have more time we can call our own; more time for family, which still remains the keystone of our social institutions; more time for community and civic responsibilities; for travel, church, cultural activities, health refreshment, and the unlimited other activities (or lack of activity) that leisure time implies.

A major social concern and opportunity derived from this transfer of hours from work to those of leisure, is that time thus provided will, in the best sense, make better lives, build active community institutions and strengthen all our

[2]Copies available from National Recreation Policies Committee, 145 E. 32nd St., New York.

democratic fibres. You will agree from your own thinking that the concern is quite general on this point. Physical science publications and statements are more frequently discussing the view that a major objective of social scientists and economists is to advance our economic and social machinery to catch up and keep pace (if such is possible) with the technological and industrial achievements.

And it is unfortunately the case that we are lacking in knowledge, understanding, and other "tools of the trade" to feel assured of the probability that the individual, his community, and the country at large are reaping the quality of benefit that in essence should come from the asset of leisure time. We have not, and perhaps cannot, measure how our quality of living has been improved by our physical benefits. There are many implications of the great impact the economics of leisure time has had in terms of incomes, but even such measurements are something less than scientific or acceptable. We must be realistic, too, about the still persistent views that leisure is flavored with the thought of wastefulness, something shameful and perhaps a bit indecent as it were. Public consideration of the problem of recreation and leisure time are most often given limited or superficial treatment. And it is one of the first items to be cut from any local, municipal, state, or federal budget. The reasoning in most cases seemingly has two common thoughts: (1) if the times are good, we don't need it; (2) if the times are bad, and in any emergency, we shouldn't spend it for such a purpose.

It is in this kind of economic atmosphere and understanding (or lack of it) that it seems to me the committee works. If any fraction of its efforts are successful in obtaining understanding of the problems and values to be gained, our lives will be the better for it.

I commend a book written in 1926 entitled *The Threat of Leisure*, by George Barton Cutten, president of Colgate University. In it he cites a creed of Dr. Robert Cabot who said, "If we are to enjoy life, we must focus our efforts upon work, play, love and worship. The interplay of these is the end of life, and sole worthy end in my creed." And Dr. Cutten's comment on this creed was enlightening: "It is not supposed these four factors are evenly distributed, but it is noteworthy that three of them are connected with leisure hours."

J. J. GOULDEN.

Caliper-Gauges for Measuring Diameters of Small Trees

Foresters sometimes need to measure trees of small diameter. When used for such measurements the ordinary steel diameter tape quickly wears out on the end, and tapes of other materials, such as plastics, often are unhandy and slow to use. To meet the need for better devices, several types of gauges have been developed at the Northern Lakes Forest Research Center.

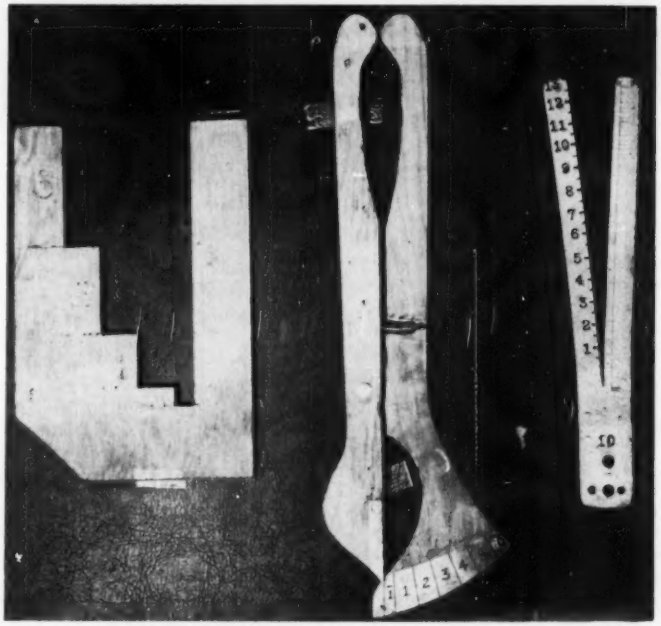

FIG. 1.—Caliper-gauges for measuring small trees.

The first gauge developed (left side, Figure 1) was made of a sheet of ¼-inch Douglas-fir plywood 10.0 inches by 6.5 inches in size.[1] The upper limit of each diameter class is used as a dimension in cutting out the notch for each of the four step openings, opposite which is inscribed the diameter class. The whole caliper is coated with waterproof spar varnish. In use, the caliper is pushed against the tree at breast height diameter and the notch in which the tree rests is its diameter class. It is suitable for measuring the following diameter classes of trees to the nearest one-inch class: Under 1 inch (0.5 inches or less); 1 inch (0.6 inches to 1.5 inches inclusive); 2 inch (1.6 inches to 2.5 inches inclusive); and 3 inch (2.6 inches to 3.5 inches inclusive).

Another caliper known locally as the "scissors-caliper," developed by the junior author, is suitable for trees 1 to 6 inches in diameter (center of Figure 1). The scissors-caliper also is made of ¼-inch Douglas-fir plywood. The left or

[1] Somewhat similar gauges for measuring the caliper of small trees were also developed and used independently by J. R. Neetzel, L. H. Reineke, and H. F. Schloz, of the U. S. Forest Service.

"pointer" side of the caliper is 14.75 inches long and 1 inch wide in the center, with the plywood on the upper 8.75 inches, beyond the tension spring, being of double thickness for greater strength, rigidity, and to provide a wider wearing surface where the caliper touches the tree. Six small flat-headed screws of ⅜-inch length are used where the plywood is of double thickness, to hold it together. The right side of the caliper is 16.75 inches long and 1.0 inch wide at the center, with double thickness plywood on the upper 8.75 inches, to match the other arm. It bears a scale of diameter classes at the bottom. Where greater accuracy is needed, readings can be taken to the nearest 0.1 or 0.2 inches, by making intermediate calibrations.

Both arms of the caliper are bored at 11.5 inches from the front end to accommodate a ¼-inch round-headed aluminum bolt (¼-inch long binder post) on which the arms of the caliper pivot. A 1.5-inch cadmium steel spring, mounted 1.75 inches beyond the pivot point, keeps the caliper closed and provides the tension of the arms against the tree stem. The inside faces of both caliper arms are sheathed with a thin ½-inch strip of copper held in place with small flat-headed wood screws countersunk into the metal. The facing reduces wear, and prolongs the life of the caliper. Copper sheet is also used for the incised scale and for the edge of the pointer to give more accuracy in reading.

Calibration is done by placing the jaws of the caliper against circles of given diameter, drawn on paper, and marking the value, or limit of the diameter class on the copper-sheet scale, where the tip of the pointer rests. The scale is then incised with a metal scribe or marking awl.

The scissors-caliper is very rapid in actual use—much more so than any tape. Slight pressure of the handles opens the jaws which are rounded or tapered to slide easily on the thrust forward so they envelop the tree. The caliper is then drawn toward the operator who watches the scale. The maximum reading obtained is the actual diameter, or diameter class of the tree being measured. The scissors-caliper could probably be made of heavy-gauge aluminum especially if mass-produced commercially.

A third type of gauge is the wedge or V-shaped caliper. It is made of ⅛-inch brass, 12 inches long (right side of Figure 1). It is an adaptation of the type described by Aamodt[2] and Hebb,[3] and is calibrated in tenth-inches, with appropriate number values stamped opposite the marks with metal stamping figures. The V-caliper shown in Figure 1 will measure trees up to 1.3 inches in diameter. Larger calipers can be devised by using a larger angle. In field use, the caliper is merely pushed against the tree and diameter to nearest 1/10-inch is read off the scale.

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Fire Resistance of Longleaf Pine Seedlings

Although longleaf pine (*Pinus palustris*) seedlings in the grass stage are, as a class, relatively fire-resistant, there are important differences in the ability of individual seedlings to withstand burning. Some causes of these differences were indicated by recent observations in southern Mississippi.

Study Methods

The excellent 1947 longleaf seed crop provided seedlings for the test. In the summer of 1948 several groups of small plots were laid out in openings in second-growth longleaf stands that had fresh burns, 1-year roughs, and 14-year roughs when seed fell. On each plot the locations of 25 to 30 longleaf seedlings from the 1947 crop were marked with wire pins. Plots varied in size from 50 to 300 square feet, depending on density of the seedling stand.

Two plots (randomly chosen from those available) on both the 1- and 14-year roughs were burned on each of six dates. The earliest fires were in August 1948 when seedlings were about 9 months old and the latest in February 1950 when seedlings were 26 months old. No seedlings younger than 9 months were burned.

On the former fresh burns, the earliest fires were in March 1949; an attempt to burn them in November 1948 failed because the herbage was still too green.

In addition, a dozen plots—on fresh burns, 1-year roughs, and 15-year roughs—were sown with longleaf seed in December 1948 and were burned in February 1950.

Since gross survival includes some weak seedlings that may linger in a nearly dead condition for a year or more whether burned or not, the results are given in terms of seedling vigor. Seedlings classed as being in fair or better vigor include all with even a small chance of making height growth. Two-year-old seedlings with fair or better vigor had at least five bundles of green secondary needles or more slightly yellowish needles.

The principal observations reported here were made in September 1950. Earlier tallies showed higher gross survival on the first plots burned but not much change in number of seedlings having fair or better vigor.

Observations

Yearling seedlings that had germinated in 1947 and 1948 on fresh burns survived fires well because the 1-year rough was too thin to carry intense fires. About 70 percent of all burned yearlings that germinated on fresh burns in 1947 and 1948 had fair or better vigor in September 1950.

In 1949 the vigor of yearling seedlings was rated before burn-

[2]Aamodt, E. E. A stem-caliper gauge for nurseries. Jour. Forestry 39(8): 728, August 1941.

[3]Hebb, E. A. Caliper for small stems. Jour. Forestry 48(5): 369, May 1950.

ing. Over ½ were vigorous, ⅓ were in fair vigor, and ⅛ were weak. All vigorous seedlings and about ¾ of those in fair vigor survived the fire. None of the weak seedlings lived.

These vigor ratings are fairly closely related to the groundline diameter of seedlings, and it may prove possible to predict survival on the basis of diameter. A few yearling seedlings were measured before burning in February 1950. All those 0.20 inch in diameter and about ⅔ of those 0.15 inch in diameter lived through a winter grass fire. One-third of the 0.10-inch and no 0.05-inch seedlings lived. A few yearlings that had germinated on 1-year or older roughs survived almost as well as those of equal size that had germinated on fresh burns. However, the older the rough the fewer the big seedlings, so the average survivals were lower.

Plots with seedlings germinating on 1-year and 14-year roughs in December 1947 were burned when seedlings were 9, 11, 13, 16, 21, and 26 months old. The older the seedlings were at the time of the fire, the better they survived. Less than 10 percent of the 9-month-old seedlings survived. About 30 percent of the seedlings burned in March 1949, when they were 16 months old, had fair or better vigor in September 1950. For seedlings burned in February 1950, when they were 26 months old, the comparable figure is 40 percent.

In the two areas where these observations were made there was little difference in survival between seedlings germinating on 1-year roughs and on 14-year roughs. This is partly because the seedlings were found only in thin spots in the older rough, partly because there had been less fuel accumulation on the poorer site occupied by the older rough than on the better site in the 1-year rough, and partly because seedlings that germinated in the younger rough were trampled by cattle concentrating on the small burned plots—no cattle grazed the older rough. Somewhat higher survivals may be expected among the seedlings germinating on 1-year roughs where subsequent burns are large enough in area so that only a small proportion of the seedlings are trampled or where grazing is not permitted. Survival will undoubtedly be lower on heavier old roughs.

The age and composition of the rough may influence survival more than on these former 1- and 14-year roughs. Seeds that germinate while suspended in old roughs often produce seedlings with a stem-like exposed root of a half inch or longer. In these tests, such seedlings, while still small, appeared more susceptible to fire than those that had germinated directly on the mineral soil. In the perennial grass fuel there were usually one or two grass tufts per square foot; the farther a seedling was from such a tuft the better it survived fire. It also appeared that the species of grass might affect seedling mortality because of differences in intensity of grass competition or of combustion. Mortality was much heavier near the edges of the opening in the old longleaf stand, probably because fallen needles made the fires much hotter than in pure grass fuel.

The better survival of seedlings first burned at 2 years of age is probably due to their larger size (0.20 to 0.40 inch in diameter as compared with 0.10 to 0.20 inch for yearlings). This study sheds no light on the probably greater fire resistance of healthy 3-year-olds than of younger seedlings.

Two earlier studies, however, have indicated that when grass-stage longleaf are about ready to start active height growth (with ground-line diameters between ¾ and 1 inch), fires kill few seedlings that would not have died from other causes in the next 2 to 4 years. Part of a longleaf plantation in central Louisiana was burned 3 years after planting; 2 years later 55 percent of the burned seedlings were alive, while 56 percent of nearby unburned seedlings still lived[1]. In a test in Mississippi, some plots were burned 4 years after direct seeding. Survival for the next 4 years averaged 65 percent both on the burned plots and on nearby unburned plots[2]. In both these tests light fires reduced brown-spot infections and also improved subsequent height growth.

DAVID BRUCE,
Southern Forest Experiment Station, New Orleans, La.

Bulletins Sought

The Department of Forestry at the University of Missouri is anxious to obtain certain bulletins in the Yale School of Forestry series as well as in the technical publications of the New York State College of Forestry. Anyone who has any of the bulletins listed below which he would like to dispose of should write to the Forestry Department, University of Missouri, Columbia.

The bulletins which are needed in the Yale School of Forestry series are: 1, 2, 3, 28, 31, 37, and 39. The bulletins in the technical publications in the New York State College series are numbers 1 to 7 inclusive, 9, 13, 14, 15, 17, 21, 25, 29, 38, 41, 48, 49, 50, and 70.

Porcupines and Aspens

In the prospectus of a new book by Dorothy Lathrop, *Let Them Live*, published by MacMillan and Company, is found the following statement, that will be of interest to foresters.

"Porcupines have work to do cutting down the young aspens which spring up so fast they crowd out other trees."

Surely the triumph of scientific facts over emotional raptures is long in coming.

H. H. CHAPMAN.

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[1]Wakeley, P. C. and H. H. Muntz. Effect of prescribed burning on height growth of longleaf pine. Jour. Forestry 45: 503-508. 1947.

[2]Bruce, D. Fire, site, and longleaf height growth. Jour. Forestry 49: 25-28. 1951.

Points of View

Sound Economics! Dollars or Forests?

In his guest editorial in the July JOURNAL, R. A. Colgan, Jr. develops an issue which has long puzzled many foresters. Living within our means is an obvious rule of life for every individual; to fail to respect it can only mean bankruptcy. But when an analogy is made to apply to government fiscal policy, Mr. Colgan steps into rather embarrassing grounds.

Most modern economists will agree that a federal budgetary surplus is essential during periods of economic prosperity. But during a depression a balanced budget may actually intensify unemployment and suffering. When communism threatens to engulf the democratic world, niggardliness in defense can only result in common disaster. The dollar alone is an inadequate guide to long run decisions as we shall shortly demonstrate.

The author went to considerable length to justify a forest resource deficit policy on his own logging operations in order to make a dollar profit. Granted that force of circumstances left no other choice a generation ago. Sooner or later the company faced the day of reckoning. When we look at our national forest resource picture we find that the same industry spokesmen who are so concerned about our federal fiscal policy show little real concern over the continued unbalance of our forest resource budget. Instead too much effort is made through pamphlets and advertising to show that all is well with "Our Abundant Forests." As a practicing forester and timber owner my own feeling is that this continued growth deficit over the nation has now brought about the day of reckoning; and that the forecasts of timber famine by Pinchot and others were not so wrong as some modern critics would have us believe. If a nine-fold increase in jack pine stumpage and a three-and-a-half fold increase in the price of lumber since World War II is not indicative of a timber shortage, we are simply refusing to face elementary facts. If a static lumber production for nearly 50 years in the face of a building boom, while prices climb ever higher doesn't indicate a shortage then the law of supply and demand is meaningless!

Let us all be frank enough to face both the facts that a continued federal deficit in both dollars and trees is bad for the nation. Only when we recognize these facts will we be able to act intelligently upon them. Both require discipline and courageous policies — real government economy along the Hoover Commission recommendations, taxation based upon ability to pay, a forest policy which will keep our long run annual cut in line with our long run growth capabilities.

CHARLES H. STODDARD.

Praise for Dr. Braun's Book

The monograph[1] by Dr. E. Lucy Braun (*Deciduous Forests of Eastern North America*) represents the most comprehensive and detailed set of theories, to date, to account for the deciduous forest complex of eastern North America. The study and critical analysis of this type of work are fundamental to the development of sound silviculture practices.

In order to understand where a basic floristic study such as this fits into the forester's study program, one must understand the purposes and types of forest classification. Two main types of classification are used, technical and natural. The technical classifications, which are based on utilization, have reached a high degree of development because of their economic importance. The development of the natural systems, primarily developed and used by botanists, has progressed more slowly because of the smaller number of interested persons and the lack of the highly trained technical assistance which is available to foresters.

The main differences between the two types of classification are in points of emphasis. The forester is interested in the individual stand as a unit, and seldom attempts more than a general correlation of one stand with another. The ecologist and plant geographer are primarily interested in the higher levels of classification and are usually more concerned with patterns of distribution than with the individual units. This divergence of interests is fortunate, for the work of these two groups of workers is highly complementary. Too often, unfortunately, one of the groups fails to appreciate and to utilize the data accumulated and prepared by the other.

The approach to forest classification used by Dr. Braun is genetic. The concepts involved have roots in the distant past, and deal with the factors which have led to the development of our present day forests. By better understanding the origins of broad forest patterns, the planners and developers of policy, as well as the least technicians, can develop a more comprehensive insight into the background of our forest management problems. Dr. Braun's work should prove to be extremely helpful in this respect, providing perspective which it has been extremely difficult to get from the scattered literature. Its usefulness will be limited only by the degree to which it is studied.

It should be understood that the writer does not necessarily agree with all the local interpretations of Dr. Braun. Here treatment of the Cumberland Plateau of Tennessee as a part of the present mixed mesophytic forest involves assumptions which not all of her readers will be willing to make.

It is significant that no more than one person has undertaken the task of describing the entire

[1]Reviewed in the May 1951 Journal of Forestry, pages 372-374.

deciduous forest complex as it existed in the original condition. It is, unfortunately, already too late for another generation to see more than poor and scattered remnants of what was once the forest primeval of eastern North America. Such a condition exists because of the past policy of *laissez faire* on the part of the American public toward natural resources.

Present and future generations of foresters, botanists, zoologists, and numerous other workers, will be deeply indebted to Dr. Braun for this gift of her life work. Even the most violent dissenters with her personal concepts and philosophy of vegetation will readily admit the fundamental significance of this contribution to our understanding of an extremely complex natural phenomenon.

FRANK W. WOODS,
University of Tennessee.

Logging and Runoff

The belief that logging increases the runoff from forested watersheds, with the disastrous effect of floods alternating with extreme low water and the general devastation of the land involved has been presented to most of us from the primary grades up. The information gathered by the weather station at Albany, Oreg., tells how it actually works in one case at least. The figures from this station were tabulated and discussed with a dozen or so people who are interested, and are familiar with what goes on. As one expert put it, "If you are trying to prove that logging has had a serious effect on the runoff around here, Id say that you have failed!"

The station has precipitation records and river gauge readings from 1879 on. In 1896 the U. S. Geological Survey started converting the gauge readings into runoff figures, giving the annual discharge of the upper Willamette River in terms of acre-feet. The figures can be found in *The Supply of Surface Water in the U. S.*, printed annually by the Survey.

The McKenzie, Middle, and Coast Forks of the Willamette, and the Long Tom River are in Lane County. The Calapooia River is in Linn County. Mary's River is in Benton County. All these branches enter the Willamette above Albany. The area is 4,840 square miles or about 3,415,000 acres. Not all of it is forest; much is cultivated area.

Logging on a not very large scale has been going on for a long time in this area, but the distance from a salt water port made the export market impracticable until the last 10 or 15 years. The demands of the war market and the advance of the logging front started a number of operations. From 1925 to 1930 the average yearly cut was around 330 million feet. From 1930 to 1940 the cut came to about 360 million feet. From 1940 to 1948 the average was about 900 million. Since 1948 it has been over a billion feet. The total area logged since 1925 is about 10 percent of the drainage. Since this area is not all forest, the proportion of the timbered area cut is considerably larger (perhaps 15 percent). Of course, a lot of farm land has been cleared and put into cultivation during the past 50 or 60 years. That might have something to do with the way the water behaves.

What effect did this logging have on the runoff? The all time high stage in the river was in 1861. The water reached 36 feet that time. Twenty feet is flood stage. In the 1880's it reached 33.9 feet; in 1901-1910 it reached 31.3, 31.0, 30.4, and 30.5. Since 1910 it has reached 30 feet twice, the last time in 1943. The average of high readings is like this:

	Average high gauge reading
1881-1890	26.2
1890-1900	22.5
1901-1910	23.7
1911-1920	21.63
1921-1930	21.56
1931-1940	20.26
1940-1949	21.4

Rainfall, of course, varies from year to year. In the 1870's it rained so much and raised the average so high that, as a veteran weather man laughingly put it, "We have had a deficiency ever since." In 1881, the year's total was 59.6; in 1950, 57.2. The 35-year average is 39.44 inches, but the altitude at Albany is only 212 feet. Up the hill a couple of thousand feet or so it is probably two or three times that much. At the town of Valsetz, 50 miles distant at an altitude of 1,500 feet, the 1950 precipitation was 132 inches. Along the Cascade summit most of the country is above 4,000 feet, and much of the precipitation is in the form of snow. However, there is not much holdover. November to March are the wet months, and that is when the high water comes. There were three exceptions since 1910 when the high water of this area came in April.

The record shows that for every inch of rainfall recorded at Albany from 1940 on, about 259,100 acre-feet of water ran down the river. From 1896 to 1900, the first five years that this record was kept, the discharge was 253,640 acre-feet per inch of precipitation. The next decade, 1901-1910, the discharge was 257,750 acre-feet per inch. During the next three decades, the runoff was 233,130, 240,750, and 259,100 acre-feet per inch. In this particular, we seem to be right back where we started.

In the Douglas-fir region, north of the Rogue River drainage and west of the Cascades, the rain usually falls slowly—one inch or so a day is what we expect—not the inch or so an hour that is common in other places. Obviously that makes a difference in the speed and volume of water running down the hill, and the amount of soil it can carry away.

In any case, the amount of limbs, tops, and other material on the ground after logging is usually enough to hold back most of the water. Water runs down roads, tractor trails, and tracks where logs have been dragged, but that is about all, as a usual thing. Even following a fire, or after slash burning, the period during which the ground is bare is usually short in this part of the country. Weeds and grass start early in the spring following the clearing and usually make an effective ground cover. Fireweed, for example, may take over by June or July. Bracken

may cover the ground in a year or so. Vine maple, salal, huckelberry, and other hardwoods are not killed by the fire. They sprout at once. Restocking by Douglas-fir and hemlock usually follows, before too long. These plants furnish protection against erosion, probably as good as the virgin forest.

It is likely that improved protection from fire has something to do with this low runoff. The practice of partial slash burning instead of the oldtime broadcast burns would have a favorable effect on the way the runoff behaves.

As the figures show, the snow does not stick on the ground very late—only three instances of the peak of runoff in April at this station. We get most of our weather from the Pacific Ocean. We get an occasional storm from Canada but the Pacific airmass covers the Douglas-fir region most of the time, and the generally warm atmosphere melts the snow at all but the comparatively small areas of high altitude. Further north and near the higher ranges there may be exceptions, but unlike the country east of the Cascades, the snow, for the most part, melts quickly.

Not all the water that falls in the watershed runs down the hill into the creek. Some of it evaporates. In some California irrigation districts, for example, trees beside the creeks are cut. A few big cottonwoods will use as much water as an acre of cabbages. The temporary shrub, weed, and grass cover that takes possession of logged off land, and the young stand that usually comes in, transpire a lot of water, but this takes place from April to October, when floods are not a problem. During the winter, which is the rainy season, plant life is dormant and transpiration has not much to do with flood control.

Our Douglas-fir forests are generally on sloping ground with rather shallow soil. This does not offer a very roomy storage space for water, but as a matter of course, a substantial part of it gets to the main drainage in sub-surface flow.

The Dorena Dam and Fern Ridge Reservoir are both on very small tributaries. They may take a little credit for holding down the floods, but not much.

In recent years, the water in summer is lower than it has been formerly—sometimes as much as a foot and a half. That is credited to (a) channel improvements and (b) rapidly increasing use of the water for irrigation.

The data furnished by the station gauge and the rain gauge at Albany are basic for this area. They indicate that the runoff in the Willamette above Albany has not been perceptibly affected by the rather extensive logging operations in that drainage.

The general question, however, is not quite settled yet. Some of the lads suggest that the information for some other streams should be worked over. Take the Trask and Wilson Rivers, that lie inside the Tillamook Burn — what happened to them? How about the parts of the Olympic peninsula where the rainfall is 170 inches? How about some of the country that has been burned hard three times and the vegetation is slow about coming back? How about the past and present behavior of the Nehalem River in Columbia County, where most of the watershed has been logged?

The effect of logging on runoff in the Douglas-fir region will still stand some study, but the outcome is not necessarily disastrous. The Albany station makes it look rather hopeful.

Everett H. MacDaniels,
Portland, Oreg.

Our forests ought to be put to work and kept at work. I do not minimize the obstacles that have to be met, nor the difficulty of changing old ideas and practices. We must all put our hands to this common task. It is not enough that the Federal, State, and local governments take the lead. There must be a change in our National attitude. Our industries, our land owners, our farmers, all our citizens must learn to treat our forests as a crop to be used but also to be renewed. We must learn to tend our woodlands as carefully as we tend our farms. —By President Calvin Coolidge in a Proclamation for American Forest Week, 1925.

Reviews

Planung und Kontrolle im Forstbetrieb.

By Hermann Knuchel. 346 pp. Illus. H. R. Sauërlander, Aarau. 1950.

It is a rare occurrence when two books on forest management do not overlap on a single title in their bibliographies. However, a comparison of the late D. M. Matthews' *Management of American Forests* and Prof. Knuchel's treatise shows that the two bibliographies are entirely dissimilar.

Knuchel divides his planning and control text into three major sections: theoretical concepts of forest management, working plans, and a practical example of a working plan combining the concepts of the first two sections.

The theoretical section receives the major emphasis. It considers the general goals of management as well as excellent discussions on the normality concept, normal growing stock, and actual growing stock including regulation methods and inventorying. Growth determination and yield are discussed in detail. The chapter on yield regulation methods includes treatment of the division into cutting areas, determination of cut from stocking and growth, and the French *methode du controle* as well as general subject coverage. The concepts of d'Alverny, Biolley, Gurnaud, and Schaeffer form the foundation for these portions of the text.

As one might expect from a Swiss author, the selection system receives more than a fair share of the theoretical presentation. A short discussion on coppice systems and grazing forests concludes the theoretical section.

The section on management plans deals first with technical details inherent in the preparation of management plans and then discusses plan administration and mechanics of control.

The working plan example is taken from the working plan of the Regensberg municipal forest and was written by Forstingenieur D. Steiner. This provides an excellent tool for integrating the discussion portions of the text in a practical manner.

Two minor criticisms are offered. Very few American authors are cited, although Knuchel cites himself 23 times in the bibliography. several small deviations were noted between the original literature and Knuchel's text.

All things considered, this book is most certainly recommended reading. It brings out European concepts that should prove refreshing and thought-provoking for many of us not schooled in the forest management methods of the Continent.

THOMAS C. NELSON,
Southeastern Forest Experiment Station.

Steve Mather of the National Parks.

By Robert Shankland. 326 pp. Illus. Alfred A. Knopf, New York. 1951. $4.

It is a good thing that a democracy can produce strong and independently wealthy men whose idealism can stand the shock of battle in which no punches, political or other, are pulled. That is the sort of battle described in *Steve Mather of the National Parks* and the story of its leader, a "practical idealist," makes good reading for the citizen as well as for the student of conservation history. And practical he was, according to the author, to the extent of using innumerable clever devices to influence congressman, editor, bureaucrat, railroad executive, cabinet officer, and Chief Executive through three administrations, and keeping his hands clean while doing it.

Not the least interesting feature is the author's recital of what he calls "Mather's red-tape scare" when Secretary of the Interior Franklin K. Lane offered him the post of assistant secretary in the hope that he could make sense out of a scattered set of neglected national reservations set aside for "pleasuring grounds." This was in 1914, three years before the National Park Service was put into gear, and if there had been no Horace Albright to "consider staying and keeping me [Mather] out of jail," there probably would have been no "Steve Mather of the National Parks" but only a Steve Mather. Albright was then twenty-four years old and a law student working as a bureau employe in Washington. Indeed one wonders if this book should not have been named "Mather, Albright and Co. of the National Park System," for it contains almost as much about Albright and other people and about national monuments, cemeteries, historical parks, and battle grounds as it does about the real and impressive national parks and their great champion.

Concerning Stephen Mather himself, there is so much background material presented as to be almost tiresome but this is perhaps justified because it tells of the sources of the wealth, character, business sense, and sheer ability which came to mean so much in the man's real life work.

Mather's leadership has become a matter of history by making the people of the country realize that there are such things as national parks and that they should "See America first"; establishing the principle of regulated monopoly in attracting capital and recruiting service businesses or "concessions" in the parks; recruiting and inspiring a park service organization to replace the makeshift army custodianship and to avoid the pitfalls of political patronage; inspiring the general belief that the automobile was not a violater of the sanctity of the parks but a way to assure equitable use by large numbers; promoting park-to-park highways; fighting off, slowly but surely, the fraudulent claimants of mining locations, in which he had even to grapple with congressmen

as principals; resisting the constant pressures to exploit timber, water, and forage of the parks; constantly reconciling the almost irreconcilable viewpoints of those to whom growing use of the parks, with all its beating power, seemed right, and that of the "primitivists" as the author calls the sanctuary wing of the park advocates; encouraging, by contributions from his own fortune, the policy of acquiring privately held lands within the national parks which interfere violently with their sound administration; realizing that even though they must be purchased, national parks must be established in the East, and obtaining the help of benefactors and of states in such a program.

There was no bloodshed in these battles, and on Mather's part, more is the wonder, almost no ill will, in the author's opinion Constant emphasis throughout the story is placed on the charm and friendliness of the man, and his almost intuitive understanding of his fellowmen. But even the great leader had his periods of deep discouragement and inactivity and finally, of physical breakdown in his early sixties. His human qualities, some of which might bother even his friends, are not glossed over but may readily be forgiven. His attitude toward the control of any particular predatory species which he did not like; his countenancing of the operation of fish hatcheries in the parks and even the introduction of exotic animal species; his patience with such "national parks" as Platt, Hot Springs, and Wind Cave, which may have humanitarian and political, but certainly no other great values, in a group otherwise of towering quality—these hardly square with fundamental national park policy and even to some extent violate the "leave them unimpaired" phase in the famous policy statement.

It is fortunate that this book, in spite of its title, carries on far beyond Mather's time, covering quite thoroughly the directorships of Albright, Cammerer, and Drury. Tribute is paid to dozens of park service men, scientists, editors, and congressmen, in the final chapters. Prominent among them are Robert Sterling Yard, Mather's right hand publicity man, Congressmen William Kent of California and Louis C. Cramton of Michigan, Gilbert Grosvenor of the National Geographic Society, George Horace Lorimer, editor of the *Staurday Evening Post*, George Bird Grinnell, zoologist, Frederic Law Olmsted, landscape architect, and J. Horace McFarland, printer and official of the American Civic Association.

Great credit is given the western railroads for making the national parks better known and for furnishing accommodations for travellers in the parks.

An unlabelled appendix carries a map showing the existing and projected national parks and monuments at the time of Director Mather's retirement, a list of parks and monuments as of 1915 with some helpful explanatory notes about several of these reservations, a full list of units in the "National Park System" as of 1929, and a list for 1951 containing 172 separate reservations. Finally there are listed projects and areas under the jurisdiction of the National Park Service but not within the National Park System. The grand total figures out 24,436,942.76 acres of which it is explained that 800,000 acres are not federally owned and for the most part should be acquired by the national government. Three and a half pages of bibliography are presented and there is a complete and helpful index. Some twenty-four illustrations are carefully selected, beautifully reproduced, and add considerable historic value to the text.

Were it better documented, this book would not only serve to interest the casual reader but as a text for college courses in land use and land policy. It does, however, show the mark of free lance writing on the part of an author who, though he is said to have "a constant interest in conservation," leaves the impression that the only thing identifiable as *conservation* is the preservation and administration of recreational and inspirational natural resources. It is the opinion of this reviewer that Stephen Mather, keen business man and great American, would hardly approve such a viewpoint.

Shirley W. Allen,
University of Michigan.

Trees of the Western Pacific Region.

By J. Hugo Kraemer. 436 pp. Illus. Tri-State Offset Company, Cincinnati 2, Ohio. 1951. $5.50.

During the recent war J. Hugo Kraemer compiled two publications for the Navy Department, issued by the Bureau of Yards and Docks. They described the native species capable of producing woods for construction purposes in the Western Pacific Region and the South China Sea Region. Because this material was intended for the use of the armed forces operating in those theaters, the publications were "classified"—that is, restricted in distribution—and thus were not available for general use. When, after the war, the books were "declassified" the supply had become exhausted, and they were in consequence still not available to many interested persons.

Dr. Kraemer has rendered a signal service to the world's tree literature by bringing out this new book. A cursory glance at its contents is sufficient to indicate that considerable search of many scattered and far-flung records preceded its writing. The author makes no claim as to its completeness. Keeping in mind that the material was originally assembled for the use of the military, he has confined his descriptions to accessible species—those growing "at low elevations, near beaches, and along water-courses."

Represented are 50 families, 119 genera, and 178 species. According to the author, "This is the first time that botanical descriptions, illustrations, and descriptions of the woods of these trees have been combined and made available in American literature." His intention was to include all useful information, at the same time keep-

ing the descriptions brief and avoiding highly technical terms.

The woods vary widely in their several properties, especially in durability. But they have a wide range of practical uses, mostly for rough construction, but some for fine veneers and cabinet making. However, many species are included, not because they are now, or are ever likely to become, commercially important, but because they are naturally distributed where advance bases were built, and may have to be built again.

The drawings accompanying the descriptions were made from herbarium specimens at Harvard University and the Smithsonian Institution. These illustrations, one-fourth natural size, include leaves, flowers, and fruit. They are drawn with great precision and detail, and are sharply reproduced.

"Whether we like it or not," says Dr. Kraemer, "our national interests and responsibilities are now no longer limited by our Atlantic and Pacific coastlines. Greater knowledge of the rest of the world is urgently needed if we are to carry out our part in world affairs in an intelligent manner. It is hoped that this book will contribute in some measure to that objective."

This is a worthy project and the author is to be commended for undertaking it.

HENRY CLEPPER.

The Conservation of Ground Water.

By Harold E. Thomas. 327 pp. McGraw-Hill Book Company, New York. 1951. $5.

Publication of this book helps fill a big gap in hydrological literature. Since, by their land management practices, foresters affect several phases of the hydrologic cycle including that of ground water, this book should also be of special interest to them.

During recent years interest in this subject has been sparked by numerous, nationwide newspaper accounts of declining ground water tables. In the field of conservation, this subject has generated controversy as to the part played by land occupancy on these recessions, and as to the effect of soil conservation measures on ground water recharge. Dr. Thomas covers these and many other phases of the subject. One of the important points he makes, for instance, concerning the many reports of declining water tables, is that such declines are inevitable when water is taken from a well. As the water table drops, according to the author, recharge may increase if the cone of the depression reaching away from the well taps new sources of recharge. Recharge then in many cases may finally equal draft.

To allay public fears as to widespread ground water shortage, the author states in the introductory first chapter that the over-use of ground water, while it affects a considerable part of the population dependent on this source of water supply, actually affects less than 5 percent of the area of the country. For the greater part of the one-half of the country that possesses appreciable ground water supplies, water levels are not declining. This however may be no great solace. For related to these facts is the author's own admission that the serious problems are where significant quantities of water are withdrawn. Or, in other words, the nonproblem areas for the most part are those where demand is slight. This rather weakens any argument that presents ground water shortages on an areal basis.

Following the introduction is a brief discussion of hydrological principles with particular emphasis on ground water. Included in this chapter is a valuable map, prepared by the author, showing areas in this country in which moderate to large supplies of ground water may be obtained.

Chapter 3 on problems resulting from ground water development and use is the heart of the book. Here the author draws on his own experiences and travels, and on many published reports, to present an excellent survey of ground water problems. Capsule descriptions, models of brevity of over 70 problem areas, are used to illustrate the different types of problem. Time and again, the author brings out the fact that these problems have developed principally because of lack of knowledge of ground water hydrology.

The subject of the succeeding chapter, the effect of land occupancy on ground water problems, does not lend itself so well to the presentation of facts and figures. In this chapter the author worked hard to bring together what facts are available, but there aren't many. Experimental work at Coweeta and Copper Basin in the East and Sierra Ancha in the West are used, among other examples, to show how land use affects streamflow and erosion. These, however, do not indicate the effects on ground water except for the strong inference that when high surface runoff occurs, as in the Copper Basin, less water is available for ground water recharge.

The last two chapters dealing with the ever-increasing requirements for water and ground water development are well and thoughtfully written and deserve careful reading.

Western foresters might disagree with, or at least wish to qualify, a few statements in the book. In chapter 4, for instance, the statement is made that forest, soil, and associated resources in the mountainous water-yielding area of the West are subordinate in value to the water resource. This statement is valid only if the known dependent relationships of forest or range vegetation, soil stability, and usable water yields are considered. Intermountain foresters may disagree that streambank vegetation may be sacrificed to increase water yield.

But these few and isolated exceptions do not detract from the general excellence of this work. The Conservation Foundation, which sponsored publication, and the author have made a significant contribution to a subject which, largely because it is underground and out of sight, has not received its due attention.

HOWARD W. LULL,
U. S. Forest Service.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, The New York State College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

From Trees to Paper at Crossett. 45 pp. Illus. Crossett Paper Mills, Crossett, Ark. 1951.

Smoke Over Skygak. By Kenneth Gilbert. 192 pp. Ages 12-16. Henry Holt & Co., New York 10. October 1951. $2.50.

That You May Always Remember Crossett. 32 pp. Illus. The Crossett Companies, Crossett, Ark. 1951.

World Resources and Industries; A Functional Appraisal of the Availability of Agricultural and Industrial Materials, rev. ed. By E. W. Zimmerman. (Trees and Crops, p. 374-397; The Forest and Its Products, p. 398-420) 832 pp. Illus. Harper & Bros., New York 6. 1951. $7.50.

Forest Economics

Forest Taxation in Europe and New Zealand; A Critical Examination of the New Zealand System. By M. B. Grainger. 107 pp. New Zealand Forest Serv., Wellington. Info. Ser. No. 11. 1950.

Forest Influences

Design and Operation of Rocky Mountain Infiltrometer. By E. J. Dortignac. 68 pp. Illus. Rocky Mt. Forest and Range Expt. Sta., Fort Collins, Colo. Sta. Paper No. 5. 1951.

Forest Management

Growth Tables for Cut-Over Larch—Douglas-Fir Stands in the Upper Columbia Basin. By A. L. Roe. 24 pp. Northern Rocky Mt. Forest and Range Expt. Sta., Missoula, Mont. Sta. Paper No. 30. 1951.

Forest Resources

Arkansas Timber Stands Before and After Cutting. By H. S. Sternitzka and L. M. James. 15 pp. Illus. Southern Forest Expt. Sta., New Orleans, La. Forest Survey Release 67. 1951.

Changes in Forest Conditions 1936-1949 North Central Minnesota and Upper Peninsula of Michigan (A Preliminary Analysis). by R. N. Cunningham. 20 pp. Lake States Forest Expt. Sta., St. Paul 1, Minn. Sta. Paper 25. 1951.

Photo-Lithographed Forest Maps. By G. A. Spear. 14 pp. Illus. Canada Dept. of Research and Development, Forestry Branch. For. Res. Div., Ottawa. 1951. Forest Air Survey Publ. No. 7. Mimeog.

Land Use

Overburden Analyses and Strip-Mine Conditions in the Northwestern District of the Ohio Coal-Mining Region. By G. A. Limstrom and R. W. Merz. 36 pp. Central States Forest Expt. Sta., Columbus 15, Ohio. Tech. Paper 124.

Logging and Milling

Pulpwood Production Costs in Southeast Arkansas, 1950. By R. R. Reynolds. 17 pp. Southern Forest Expt. Sta., New Orleans, La. Occasional Paper 121. 1951.

Short Log Operations Pacific County, Washington. By C. J. Kantzer. 8 pp. Illus. Washington Dept. of Conservation and Development. Inst. Forest Products, Seattle, Wash. Cir. No. 12. 1951.

Protection

Correction of Burning Index for the Effects of Altitude, Aspect, and Time of Day. By G. R. Fahnestock. 3 pp. Tables. Northern Rocky Mt. Forest and Range Expt. Sta., Missoula, Mont. Res. Note 100. 1951.

Fire and Water in Southern California's Mountains. By E. A. Colman. 8 pp. California Forest and Range Expt. Sta., Berkeley. 1951. Misc. Paper 3.

Forest Fires in the Northern Rocky Mountains. By J. S. Barrows. 251 pp. Illus. Northern Rocky Mt. Forest and Range Expt. Sta., Missoula, Mont. Sta. Paper 28. 1951.

Les Méthodes d'Évaluation des Dangers d'Incendie Forestier en Amerique du Nord. By Paul Reneuve. 12 pp. Québec Ministère des Terres et Forêts. Bul. 19. Réimprimé de la Rev. Forestière Française.

The Preparation of Visible Area Maps by Field Sketching. By R. W. Chorlton. 16 pp. Illus. Canada Dept. of Research and Development, Forestry Branch. For. Res. Div., Ottawa. Forest Fire Res. Note 16. 1951.

Range Management

Bibliography on Brush Control. By W. Kalenich. 59 pp. Southwest Research Inst., San Antonio, Tex. 1950.

Forages. Ed. by H. D. Hughes and others. 724 pp. Illus. Iowa State College Press, Ames. 1951. $6.75.

Harvesting and Cleaning Grass and Legume Seed in the Western Gulf Region. By S. E. Wolff. 106 pp. Illus. Washington 25, D. C. U. S. Dept. Agriculture, Agric. Handbook No. 24. June. 1951. 65 cents. (Govt. Print. Off.)

Registration of Varieties and Strains of [various grasses]: Bermuda Bromegrass, Fescues, Wheatgrass. By W. M. Myers. Agronomy Jour., Geneva, N. Y. Vol. 43, pp. 237-241. May 1951.

St. Johnswort on Western Ranges. By G. A. Harris. 18 pp. Illus. U. S. Forest Serv., Northern Rocky Mt. Forest and Range Expt. Sta., Missoula, Mont. Sta. Paper No. 26. February 1951. Mimeog.

Some Typical Practices of Range Improvement in Texas. 18. pp. Southwest Research Inst., San Antonio, Tex. 1950.

Tree Farms

Trees Forever; The Story of a Dream Coming True. 20 pp. Illus. American Forest Products Industries, Washington 6, D. C. 1951.

Silviculture

Banks Pine in Pennsylvania. By H. H. Chisman and W. C. Bramble. 16 pp. Illus. Pennsylvania State College Agric. Expt. Sta., State College. Bull. No. 538. 1951.

Effect of Slash Mulch and Slash Burn on Pine and Spruce Plantings. By H. A. Lunt. 21 pp. Illus. Connecticut Agric. Expt. Sta., New Haven. Bul. No. 548. 1951.

Forest Planting Sites in North Mississippi and West Tennessee. By W. M. Broadfoot. 15 pp. Illus. Southern Forest Expt. Sta., New Orleans, La. Occasional Paper No. 120. 1951.

Recent Direct Seeding Trials in the Pine Region of California. By H. A. Fowells and G. H. Schubert. 9 pp. California Forest and Range Expt. Sta., Berkeley. Forest Res. Notes No. 78. 1951.

Reforestation of Strip-Mined Lands in West Virginia. By H. S. Potter, Sidney Weitzman and G. R. Trimble, Jr. 28 pp. Illus. Northeastern Forest Expt. Sta., Upper Darby, Pa. Sta. Paper No. 43. 1951.

Wood Technology and Utilization

The Effects of Three Factors Upon the Cross-Breaking Strength and Stiffness of Red Pine. By J. H. Kraemer. 19 pp. Illus. Purdue Univ. Agric. Expt. Sta., Lafayette, Ind. Sta. Bul. No. 560. 1951.

Green Harvest; (The Story of Pulpwood Production) by Brown Company, Berlin, N. H. 55 pp. Illus.

Red Alder in British Columbia. By K. W. Rymer. 19 pp. Illus. Canada Dept. of Research and Development, Forestry Branch, For. Prod. Lab. Div., Ottawa. Bul. No. 98. 1951.

Wood Box Columns and Their Design. By B. Y. Kinzey, Jr. 22 pp. Illus. Virginia Polytechnic Inst., Blacksburg. Engin. Expt. Sta. Ser. 79. 1951.

Wood Technology; Constitution, Properties and Uses, 3d ed. By H. D. Tiemann. Pitman & Sons, Ltd., London. 1951. 30s.

Wood Used in Manufacture 1948. By G. D. Merrick. 66 pp. U. S. Forest Serv., Washington 25, D. C. For. Res. Rept. 2. 1951.

Society Affairs

Compiled by ROBERT D. HOSTETTER, *Assistant Executive Secretary*

Officers and Members of the Council, 1950-1951

CHARLES F. EVANS, *President*
2867 Piedmont Road
Atlanta, Ga.

CLARENCE S. HERR, *Vice President*
Woods Department
Brown Company
Berlin, N. H.

HENRY CLEPPER, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

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3290 N. E. Irving Street
Portland 12, Oreg.

FRANK H. KAUFERT
School of Forestry
University of Minnesota
St. Paul 1, Minn.

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Forest Service
U. S. Department of Agriculture
Washington 25, D. C.

D. B. DEMERITT
Dead River Company
6 State Street
Bangor, Me.

C. OTTO LINDH
U. S. Forest Service
Post Office Building
Albuquerque, N. M.

DEWITT NELSON
Division of Forestry
Department of Natural Resources
Sacramento 14, Calif.

STANLEY G. FONTANNA
School of Natural Resources
University of Michigan
Ann Arbor, Mich.

GORDON D. MARCKWORTH
College of Forestry
University of Washington
Seattle 4, Wash.

EARL PORTER
Southern Kraft Division
International Paper Company
Mobile 9, Ala.

Electoral Board Names Fellows on December 1

Eminent foresters nominated by petition for advancement to the Society's grade of Fellow will be considered by the electors during November. Successful nominees will be named on December 1. Selection is by an electoral board composed of present Council members and Fellows. A favorable vote of half or more of the ballots cast is required for election.

On September 1, as the October JOURNAL went to press, the Members listed below had been nominated. Nominations closed on October 8.

Fellow Nominees

Reed W. Bailey, Ogden, Utah
Nelson C. Brown, Syracuse, N. Y.
Hugh Curran, Caracas, Venezuela
Walter J. Damtoft, Canton, N. C.
Elwood L. Demmon, Asheville, N. C.
James C. Evenden, Coeur d'Alene, Idaho
Emanuel Fritz, Berkeley, Calif.
I. T. Haig, Rome, Italy
J. Alfred Hall, Madison, Wis.
Verne L. Harper, Washington, D. C.
B. Frank Heintzleman, Juneau, Alaska
Walter H. Horning, Washington, D. C.
George M. Hunt, Madison, Wis.
Joseph C. Kircher, Mount Dora, Fla.
Edward I. Kotok, Santiago, Chile
Charles J. Kraebel, Berkeley, Calif.
Myron E. Krueger, Berkeley, Calif.
Woodbridge Metcalf, Berkeley, Calif.
Fred W. Morrell, Washington, D. C.
DeWitt Nelson, Sacramento, Calif.
Harold S. Newins, Gainesville, Fla.
Jay H. Price, Milwaukee, Wis.
Arthur W. Sampson, Berkeley, Calif.
Hardy L. Shirley, Syracuse, N. Y.
E. A. Sterling, Montrose, Pa.

S.A.F. Members Receive Ballots in October

During the latter part of October the Society's 7,250 voting members will receive ballots for the regular biennial election. Ballots will be counted on December 1, 1951, and the newly elected president, vice president, and nine other Council members will assume office on January 1, 1952. Terms are for two years, with Council meetings usually being held each June and at the time of each annual Society convention.

Candidates already nominated when the October JOURNAL went to press are listed below. The names of those nominated since publication of the September JOURNAL are printed in bold faced type. Nominations were closed on October 8.

For President

Elwood L. Demmon, Southeastern Forest and Range Experiment Station, Asheville, N. C. (Appalachian Section.)

Stanley G. Fontanna, School of Natural Resources, University of Michigan, Ann Arbor, Mich. (Central States Section.)

DeWitt Nelson, Division of Forestry, Department of Natural Resources, Sacramento 14, Calif. (Northern California Section.)

For Member of the Council

Frederick H. Claridge, North Carolina Department of Conservation and Development, Raleigh, N. C. (Appalachian Section.)

Robert W. Cowlin, Pacific Northwest Forest and Range Experiment Station, 423 U. S. Court House, Portland 5, Ore. (Columbia River Section.)

Dwight B. Demeritt, Dead River Company, 6 State Street, Bangor, Me. (New England Section.)

Cedric H. Guise, Department of Conservation, Cornell University, Ithaca, N. Y. (New York Section.)

D. E. Hess, Glatfelter Pulpwood Co., Murphy Building, Gettysburg, Pa. (Allegheny Section.)

Walter H. Horning, Bureau of Land Management, U. S. Department of the Interior, Washington 25, D. C. (Washington Section.)

Frank H. Kaufert, School of Forestry, University of Minnesota, St. Paul , Minn. (Upper Mississippi Valley Section.)

E. Otto Lindh, U. S. Forest Service, Post Office Building, Albuquerque, N. M. (Southwestern Section.)

Richard E. McArdle, Forest Service, U. S. Department of Agriculture, Washington 25, D. C. (Washington Section.)

Gordon D. Markworth, College of Forestry, University of Washington, Seattle, Wash. (Puget Sound Section.)

R. Vance Miles, Gulf States Paper Corporation, Tuscaloosa, Ala. (Southeastern Section.)

Harold S. Newins, Gainesville, Fla. (Southeastern Section.)

George R. Phillips, Office of the Secretary, U. S. Department of Agriculture, Washington 25, D. C. (Washington Section.)

Earl Porter, Southern Kraft Division, International Paper Company, Mobile 9, Ala. (Gulf States Section.)

Perry A. Thompson, 12 Elkin Court, San Rafael, Calif. (Northern California Section.)

Ruthford H. Westveld, Department of Forestry, University of Missouri, Columbia, Mo. (Ozark Section.)

Robert K. Winters, Central States Forest Experiment Station, Old Federal Building, Columbus 15, Ohio. (Central States Section.)

Ernest Wohletz, School of Forestry, University of Idaho, Moscow, Idaho. (Inland Empire Section.)

Under the P.R. system it is highly important that voters determine which candidate is their top favorite and then be sure to give him their number one vote.

Bernard Frank, chairman of the committee of tellers for the 1951 election, explained the P.R. system in detail in the September JOURNAL.

Accompanying each ballot will be a professional interest card on which members are asked to designate the Society's subject matter Divisions in which they are primarily interested. These cards will be used by the Divisions in the conduct of their business.

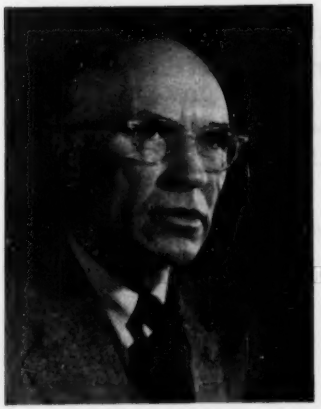
Council Candidates

FREDERICK H. CLARIDGE

Frederick H. Claridge has been nominated as a candidate for election to the Council. He is in the North Carolina Department of Conservation and Development, Raleigh, N. C.

ROBERT W. COWLIN

Robert W. Cowlin, a Council candidate in the current election, is chief of the division of forest economics at the Pacific Northwest Forest and Range Experiment Station, Portland, Ore.

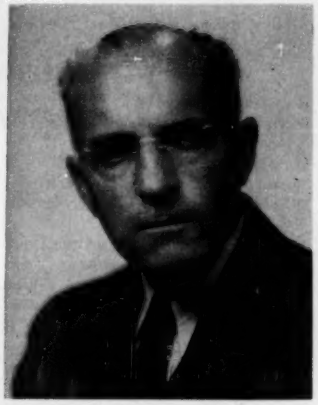


CEDRIC H. GUISE

Cedric H. Guise, professor of forestry in the Department of Conservation at Cornell University, Ithaca, N. Y., is a Council candidate. For 17 years he compiled forestry school statistics for the JOURNAL.

RICHARD E. MCARDLE

Richard E. McArdle, a member of the present Council, has accepted a nomination for reelection to that post for another term. He is assistant chief of the U. S. Forest Service, Washington, D. C., in charge of state and private forestry.



HAROLD S. NEWINS

Harold S. Newins, Gainesville, Fla., who recently retired as head of the School of Forestry at the University of Florida is a candidate for election to the Council.

ERNEST WOHLETZ

Ernest Wohletz is a candidate for election to the Council on December 1, 1951. He is a professor in the school of forestry at the University of Idaho, Moscow, and is also director of the Forest, Wildlife, and Range Experiment Station there.

51st Annual Meeting
Society of American Foresters

Buena Vista Hotel, Biloxi, Miss.
December 12-15, 1951

Schedule of Events

Tuesday, December 11

All-day, pre-meeting field trip to Bogalusa, La.

Wednesday, December 12

Registration, all day.
Morning and afternoon, meeting of Division of Education.
Morning, Local Field Trip.
Morning, meeting of Section delegates.
Morning, executive meeting of the Council.
Afternoon, joint meeting of the Council and Section delegates.
Afternoon and evening, Open House, courtesy of the Gulf States Section.
Afternoon, meeting of Association of Consulting Foresters.
Evening, meeting of National Council of Extension Foresters.
Evening, meeting of International Society of Tropical Foresters.
Evening, meeting of Division of Public Relations.

Thursday, December 13

Registration, all day.
Morning, First General Session.
Afternoon, Society Affairs Session.
Evening, Open House, courtesy of the Gulf States Section.
Morning and afternoon, Ladies' Entertainment.
Dinner and evening, Forestry School Alumni Meetings.
Evening, Forestry Motion Pictures.

Friday, December 14

Registration, all day.
Morning and afternoon, meeting of Division of Silviculture.
Morning and afternoon, meeting of Division of Forest Management.
Morning and afternoon, joint meeting of Division of Forest Products and Division of Private Forestry.
Morning, meeting of Division of Forest Recreation.
Morning, meeting of Division of Range Management.
Morning, meeting of Division of Forest Economics.
Afternoon, meeting of Division of Forest-Wildlife Management.
Afternoon, meeting of Division of Public Relations.
Afternoon, meeting of Division of Watershed Management.
Social hour (6 p.m.), courtesy of Southern Pine Association.
Dinner (7:30 p.m.), Seafood Jamboree, followed by evening program and entertainment.

Saturday, December 15

Registration, morning.
Morning, Second General Session.
Afternoon, Local Field Trip.
Afternoon and evening, meeting of Council of Forestry School Executives.

Sunday, December 16

Morning and afternoon, meeting of Council of Forestry School Executives.

First General Session

Thursday, December 13

Theme: Southern Forests—Past, Present, and Future
J. Herbert Stone, Chairman

1. Greetings and Welcome. Charles F. Evans, President of the Society.

2. "Southern Forests — Then and Now." I. F. Eldredge, New Orleans, La.

3. "Building an Industry on Cutover Lands." Paul M. Garrison, Gaylord Container Corp., Bogalusa, La.

4. "Integrating Production and Utilization." Peter Watzek, Crossett Industries, Crossett, Ark.

5. "Importance of Hardwood Utilization Trends in Southern Forestry." C. D. Dosker, Gamble Brothers, Louisville, Ky.

Society Affairs Session

Thursday afternoon, December 13

Charles F. Evans, President
C. S. Herr, Vice President

1. Report of the President, Charles F. Evans.

2. Report of the Executive Secretary, Henry Clepper.

3. Report of the Editor, Albert G. Hall.

4. Report on the Foresters' Field Manual. R. D. Forbes, editor.

5. Report of the Committee on Forest Types. F. H. Eyre, chairman.

6. Report of Committee on Policies and Objectives. F. H. Brundage, chairman.

7. Report of Committee on International Relations. Tom Gill, chairman.

8. Report of Committee on Library of Congress Photograph Collection. Helmuth Bay, chairman.

9. Report of Committee on Grade Standardization of Forest Planting Stock. David S. Olson, chairman.

10. Approved Curricula for Society Membership: A Panel Discussion.

Moderator: R. E. McArdle, chairman of the Council Committee on Membership.

Myron Krueger, chairman of the Committee on Accrediting; Berkeley, Calif.

James S. Bethel, professor of wood technology, North Carolina State College, Raleigh, N. C.

Carl Rishell, vice president, Timber Engineering Company, Washington, D. C.

Frank H. Kaufert, member of the S.A.F. Council; St. Paul, Minn.

Open forum discussion.

The Society Dinner

Friday, December 14

A social hour beginning at 6 p.m., for which the Southern Pine Association is host, will precede the dinner.

A Seafood Jamboree, for which the Buena Vista Hotel is famous, will be served at 7:30 p.m. It will be informal (sports clothing or business attire is appropriate.)

Charles H. Flory, state forester of South Carolina, will act as toastmaster for the after-dinner program. But there will be no speeches. Instead there will be entertainment featuring Justin Wilson, a Cajun humorist from Baton Rouge, La., and plantation songs and music.

Second General Session

Saturday, December 15

Arthur W. Nelson, Jr., Chairman

1. "Harnessing Farm Woodlands and Southern Industry." Edmund T. Hawes, West Lumber Company, Atlanta, Ga.

2. "The Use of Fire in Southern Pine Management." Alfred D. Folweiler, Texas Forest Service, College Station, Texas.

3. "The South's Approach to Regional Education in Forestry." William J. McGlothlin, Board of Control for Southern Regional Education, Atlanta, Ga.

4. "The Forest Future of the South." William A. Duerr, U. S. Forest Service, Washington, D. C.

5. "Impact of the National Emergency on American Forestry."

Division Meetings

Division of Education

W. C. Percival, Chairman
Glen R. Durrell, Vice Chairman
Terrill D. Stevens, Secretary

Wednesday morning, December 12

1. Report of Committee on Graduate Training in Forestry. Robert A. Cockrell, chairman, School of Forestry, University of California, Berkeley, Calif.

2. "Accrediting in Professional Forestry Education." Myron Krueger, chairman, Committee on Accrediting, Society of American Foresters; School of Forestry, University of California, Berkeley, Calif.

3. "Forest Economics, as Needed in Course Contents." William A. Duerr, U. S. Forest Service, Washington, D. C.

Wednesday afternoon, December 12

Panel: The Place of Adult Education in the Development of Small Forests.

1. "As the Landowner Sees It."

2. "From the Industrial Viewpoint."

3. "The Contribution of the Land Grant College." L. I. Jones, Extension Service, U. S. Department of Agriculture, Washington, D. C.

4. "The State Forester and the Adult Education Program."

Panel: Producing Better Foresters.

1. "Getting Better Students from the High Schools." Richard J. Preston, Jr., School of Forestry, North Carolina State College, Raleigh, N. C.

2. "Coordination of Subject Material in the Curriculum." C. M. Kaufman, School of Forestry, University of Florida, Gainesville, Fla.

3. "Gaining Public Interest and Financial Support." Paul M. Dunn, School of Forestry, Oregon State College, Corvallis, Ore.

4. "Contribution of Research to Effective Teaching in the Schools." Ralph C. Bryant, Jr., School of Forestry and Range Management, Colorado A & M College, Fort Collins, Colo.

Division of Public Relations

James H. Kitchens, Jr., Chairman
Albert Arnst, Vice Chairman
Joe N. Hessel, Secretary
S. L. Frost, Program Chairman

Wednesday evening, December 12

Informal get-acquainted meeting.

Report on the Directory of PR Foresters. Dana Parkinson, U. S. Forest Service, Washington, D. C.

Friday afternoon, December 14

1. "Essentials of Good Industrial Public Relations." Frank Heyward, Gaylord Container Corp., Bogalusa, La.

2. "Industry's Stake in Promoting the Public's Knowledge about Forestry." William C. Hammerle, Southern Pine Association, New Orleans, La.

3. "Mistakes in Public Education and What They Have Taught Us." L. L. Bishop, Texas Forestry Association, Lufkin, Texas.

4. "Good Examples of State Forestry Periodical House Organs and News Letters." A discussion and an exhibit. Ralph T. Wall, Louisiana Forestry Commission, Baton Rouge, La.

Division of Silviculture

F. S. Baker, Chairman
R. K. LeBarron, Vice Chairman
R. H. Westveld, Secretary

Friday morning, December 14

1. "Modern Trends in an Ancient Industry." K. B. Pomeroy, Southeastern Forest Experiment Station, Lake City, Fla.

2. "Results of Thinning in Longleaf and Loblolly Pine at Urania, Louisiana." H. H. Chapman, School of Forestry, Yale University, New Haven, Conn.

3. "Survival and Growth of Forest Plantations in Missouri." R. W. Dingle, School of Forestry, University of Missouri, Columbia, Mo.

4. "The Growing Importance of Forest Entomology in Forest Practices in the South." R. J. Kowal and J. F. Coyne, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Gulfport, Miss.

5. "Relation between Soil Properties and the Development of Hardwoods in Longleaf Pine Stands of the Southeastern Coastal Plains." T. S. Coile, School of Forestry, Duke University, Durham, N. C.

6. "Development of Forest Stands on Century-old Iron-ore Spoil Banks." E. H. Tryon, Division of Forestry, West Virginia University, Morgantown, W. Va.

Friday afternoon, December 14

Symposium on Southern Silviculture

C. F. Korstian, Chairman

1. "The Case for All-aged Management." Walter E. Bond, Southern Forest Experiment Station, New Orleans, La.

2. "The Case for Even-aged Management." Robert D. McCulley, Southeastern Forest Experiment Station, North Coastal Plain Research Center, Franklin, Va.

3. "From the Standpoint of Growing Sawlogs." T. Russell Moberg, Ozon Lumber Company, Prescott, Ark.

4. "From the Standpoint of Integrated Utilization of Products." George A. Anderson, Brunswick Pulp and Paper Company, Brunswick, Ga.

Division of Forest Economics

Lee M. James, Chairman
Eugene Zumwalt, Vice Chairman
John Zivnuska, Secretary

Friday morning, December 14

1. "Conservation in National Policy Today." Leland Olds, U. S. Department of the Interior, Boston, Mass. Theme: "Forest Conservation in a Time of National Emergency."

2. "Industrial Problems and Points of View." Earl W. Tinker, American Paper and Pulp Association, New York, N. Y.

3. "Government Problems and Points of View." Edward C. Crafts, U. S. Forest Service, Washington, D. C.

4. "The Point of View of a Consulting Forester." Charles Stoddard, Minong, Wis.

5. Business Meeting.

Division of Forest Products

M. M. Leabas, Chairman
Fred E. Dickinson, Vice Chairman
R. C. Fraunberger, Secretary

Friday morning, December 14

1. "Dissolving Pulp from Southern Hardwoods." D. V. Logan, International Paper Company, Natchez, Miss.

2. "Southern Pine Poles—Problems of Supply and Manufacture." J. A. Vaughn, Southern Wood Preserving Company, Atlanta, Ga.

3. "From Wood to Wallboard." Arthur W. Nelson, The Flintkote Company, Meridian, Miss.

4. "The Use of Southern Pine in Newsprint."

5. "Conservation of Wood in the National Mobilization Program." J.

Hugo Kraemer, Wood and Wood Products Division, National Production Authority, Washington, D. C.

Friday afternoon, December 14

Joint meeting with Division of Private Forestry. Program is listed under that Division.

Division of Forest Management

Stephen H. Spurr, Chairman
Donald Young, Vice Chairman
Lewis R. Grosenbaugh, Secretary

Friday morning, December 14

1. "Developments and Progress in Attacks on Southern Fire Protection Problems." A. W. Hartman, U. S. Forest Service, Atlanta, Ga.

2. "Organization and Handling of Prescribed Burning." John W. Squires, Mississippi Products, Inc., Jackson, Miss.

3. "Aerial Photographs, a Practical Tool in Forestry." T. E. Bercaw, Gaylord Container Corp., Bogalusa, La.

4. "Use of Aircraft in Disease Scouting." Marvin E. Fowler, Division of Forest Pathology, Plant Industry Station, Beltsville, Md.

5. "Interrelations between Military and Forest Photo-Interpretation." Robert N. Colwell, U. S. Naval Photo Interpretation Center, Washington 25, D. C.

Friday afternoon, December 14

1. "Possibilities of Profitable Management of Loblolly Pine." R. R. Reynolds, Crossett Experimental Forest, Crossett, Ark.

2. "The Periodic Inventory in Forest Management—a Specific Example." Walter H. Meyer, School of Forestry, Yale University, New Haven, Conn.

3. "Present Status of Management Plans in the National Forests." L. S. Gross, U. S. Forest Service, Washington, D. C.

4. Paper by DeWitt Nelson, Division of Forestry, California Department of Natural Resources, Sacramento, Calif.

5. Paper by W. K. Beichler, Division of Forestry, North Carolina Department of Conservation and Development, Raleigh, N. C.

Division of Private Forestry

M. H. Collet, Chairman
Julian F. McGowin, Vice Chairman
N. T. Barron, Secretary

Friday morning, December 14

Joint meeting with the Division of Forest Products. Program is listed under that Division.

Friday afternoon, December 14

1. "Licensing of Foresters in Georgia." Archie E. Patterson, School of Forestry, University of Georgia, Athens, Ga.

2. "Utilization Aspects of Southern Forestry." C. R. Lockard, Northeastern Forest Experiment Station, Upper Darby, Pa.

3. "Progress of Forest Management." A. E. Wackerman, School of Forestry, Duke University, Durham, N. C.

4. "Progress of Southern Forestry." Ruben B. Robertson, Champion Paper and Fibre Company, Canton, N. C.

5. "The Development of Forest Management Practices on Large Properties in the South." Z. W. White, Pomeroy & McGowin, Monticello, Ark.

Division of Forest Recreation

James H. Tyndall, Chairman
C. Frank Brockman, Vice Chairman
Harthon L. Bill, Secretary

Friday morning, December 14

1. "An Analysis of the Wilderness Area Concept." J. V. K. Wagar, Division of Forestry and Range Management, Colorado A & M College, Ft. Collins, Colo.

2. "A Practical Approach to Recreation Education." C. Frank Brockman, College of Forestry, University of Washington, Seattle, Wash.

3. "Under What Conditions Can Recreation be Considered the Dominant or Exclusive Use of Forest Lands?" Bernard Frank, U. S. Forest Service, Washington, D. C.

4. "Proper Planning of Campground and Picnic Areas." William N. Parke, U. S. Forest Service, Portland, Ore.

Division of Range Management

Edward P. Cliff, Chairman
Donald F. Hervey, Vice Chairman
Charles E. Poulton, Secretary
John T. Cassady, Program Chairman

Friday morning, December 14

Theme: Livestock Grazing-Forestry Relationships in the South.

1. Business meeting.

2. "Grazing on Texas National Forests." Paul Y. Vincent, U. S. Forest Service, Lufkin, Texas.

3. "Managing Beef Cattle on East Texas Timberland." Richard M. Townsend, Southwestern Settlement and Development Corp., Jasper, Texas.

4. "Highlights of Grazing Research in the East." Weldon O. Shepard, Southeastern Forest Experiment Station, Franklin, Va.

5. "Forest-Grazing Research in Louisiana." Walter S. Hopkins, Southern Forest Experiment Station, Alexandria, La.

6. "Getting Better Management on Southern Forest Ranges." Robert E. Williams, Soil Conservation Service, Crowley, La.

Friday afternoon, December 14

1. "Management and Administration of Range Lands in Japan." Walt L. Dutton, U. S. Forest Service, Washington, D. C.

Division of Watershed Management

Reed W. Bailey, Chairman
E. G. Dunford, Vice Chairman
Charles R. Hursh, Secretary

Friday afternoon, December 14

1. "Watershed Management in the South." H. G. Meginnis, Southern Forest Experiment Station, New Orleans, La.

2. "The Hydrologic Function of Forest Soils in Watershed Management." Peter W. Fletcher, School of Forestry, University of Missouri, Columbia, Mo.

3. "Water Yield Improvement in the United States: A Progress Report of the Conservation Foundation's Study." E. A. Colman, Conservation Foundation, New York, N. Y. (On leave from California Forest and Range Experiment Station, Berkeley.)

4. "Soil Stability Under Use." George W. Craddock, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Division of Forest-Wildlife Management

Warren W. Chase, Chairman
Paul Dalke, Vice Chairman
Richard Griffith, Secretary

Friday afternoon, December 14

1. "Present Status and Evaluation of Work Done by the Division of Forest-Wildlife Management."

2. "Review of Policies and Plans for the Future Work of the Division."

3. "Progress in the Study of Integrating the Training of Foresters and Wildlife Managers."

4. "Progress on the Forest-Wildlife Management Section of the Foresters' Field Manual."

5. "Wildlife Management Education."

Field Trips

Tuesday, December 11
To Bogalusa, La.

A pre-meeting, all-day field trip has been scheduled for Tuesday, December 11, to the forestry operations of the Gaylord Container Corp., Bogalusa, La. This is one of the interesting forestry showplaces in the South and visitors to the region should not miss it.

For those going to Bogalusa from Biloxi, transportation will be available in buses of the White Eagle Bus Company, leaving the Buena Vista Hotel at 8 a.m. The buses will return to Biloxi by 5:30 p.m.

Those travelling in private automobiles, who will stop off at Bogalusa enroute to Biloxi, should go to the Forestry Department office, directly across the street from the Bogalusa post office. They should arrive by 10 a.m. There will be guides available.

Luncheon will be served in the field by the Gaylord Container Corp. In order that the corporation officials may be able to plan on the number of lunches to be served, and to provide buses from Biloxi to Bogalusa and return, all those who desire to take this trip should notify Paul M. Garrison, chief forester, Gaylord Container Corp., Bogalusa, La.

Among the interesting things to be seen on this trip are slash pine and loblolly pine plantations of various ages which have been cut both experimentally and as practical woods operations. Some tracts are as yet unthinned whereas the oldest plantations have been thinned three times. Stops will also be made in natural longleaf pine stands, both thinned and unthinned. Information will be given as to the history of the plantations, volumes of wood removed, the present stand by tree count and volume, and expected growth.

Wednesday morning, December 12
Local Field Trip

A half-day field trip to local forestry operations near Biloxi has been scheduled for Wednesday morning, December 12. Those desiring to take this trip may register for it on arrival at the meeting.

Transportation will be available in private automobiles, leaving the Buena Vista Hotel in Biloxi at 9 a.m., and returning at noon.

On this trip there will be scheduled stops at the Dantzler Lumber Company, the Harrison Experimental Forest of the Southern Forest Experiment Station, and the Biloxi ranger district of the DeSoto National Forest. Among the things to be seen are examples of prescribed burning, cutting operations by individual tree selection, chemical stimulation for the production of gum naval stores, and various research projects. There will be a fire line demonstration, and an exhibit of fire control equipment.

Saturday afternoon, December 15
Local Field Trip

The local field trip scheduled for Wednesday morning, December 12, will be repeated on Saturday afternoon, December 15, if sufficient interest is shown in it.

Transportation will be available in private automobiles, leaving the Buena Vista Hotel in Biloxi at 2 p.m., and returning at 5:30 p.m.

Those desiring to take this trip may register for it during the meeting.

Points of Interest to Visiting Foresters

As an aid to visiting foresters who will travel by automobile to the Biloxi meeting, the following list of interesting forestry places has been specially compiled.

This is a selected list, based on highway route numbers, and is not intended to be complete or all-inclusive. Each place of interest is briefly described, and names and addresses are given of persons to contact for information and guidance. These persons will welcome visiting S.A.F. members both before and after the meeting.

East of Biloxi

Mobile, Ala.
U.S. 90.

International Paper Company. A sulphate kraft paper mill making wrapping paper and bag stock. Bag mill in conjunction. Contact Mr. Ardie Toler, International Paper Company, Mobile, Ala. For visiting woodlands enroute, make prior arrangements with Mr. Earl Porter, International Paper Company, Mobile.

Taylor-Lowenstein & Company. A modern naval stores processing plant. Visitors welcome on December 11. Contact Mr. George R. Harris or Mr. C. B. Taylor at the plant on that date.

Loxley, Ala.
U.S. 90.

Stallworth Naval Stores Company's woods operations. Contact Mr. Sam Holder, Loxley, who will show visitors over operations on December 11, 15, and 16. The processing plant of this company is located at the depot in Whistler, Ala.; visitors are welcome on December 11, 15, and 16.

Stapleton, Ala.
Alabama State Highway 3.

Tennessee Coal, Iron and Railway Company. A 50,000-acre property with splendid growth of longleaf pine, originally cut about 1900; prescribed burning practiced. Annual cut is 7½ million board feet. Operation is conducted by Georgia-Pacific Plywood Company. Contact Howard E. Baxendale, forester, at his residence 3 miles south of Stapleton on Alabama State Highway 3; telephone Bay Minette 4813.

Northeast of Biloxi

Tuscaloosa, Ala.
U.S. 11.

Gulf States Paper Corp. A sulphate kraft paper mill. Extensive woodlands in the vicinity. Items of special interest: pine plantations of different ages; selection cuttings in pulpwood and sawtimber sizes; hardwood chemical control areas; littleleaf disease salvage cuttings; truck and rail crane operations on pulpwood storage yards; and strip-mining operations on forest lands. Advise at least 10 days in advance: Division of Forestry, Gulf States Paper Corp., Tuscaloosa, Ala.

Electric Mills and Meridian, Miss.
U.S. 45, 11.

The Flintkote Company. Insulating board manufacturing plant and associated woodlands. Visitors coming South on U.S. 45 should stop one mile south of Electric Mills, Miss., at Flintkote Ranger Station; Ranger W. L. Stuckey is contact. Flintkote plant is south of Meridian on U.S. 11. Contact Mr. A. W. Nelson, Jr., or Mr. O. W. Brackman.

Choctaw County, Ala.
Alabama State Highway 29.

Hollingsworth & Whitney Company. Loblolly-shortleaf pine woodlands under intensive fire protection for ten years. Items of special interest: large scale girdling of undesirable hardwoods; about 90 miles of service road construction; partial cutting operations; lightwood pine stump sale area; scrub oak underplanted with loblolly pine. Visitors should make prior arrangements by correspondence with Mr. W. J. Bridges, Jr., Hollingsworth & Whitney Company, P. O. Box 1189, Mobile 7, Ala.

North of Biloxi

Canton, Miss.
U.S. 49, 51.

International Paper Company Woodlands. Items of special interest are radio system and noncommercial thin-

nings through use of roller type cutter. Visitors passing through can telephone 966 in Canton for information, but prior arrangement is preferred. Address correspondence to Mr. Earl Porter, International Paper Company, Mobile, Ala.

Jackson, Miss.
U.S. 49, 51, 80.

Mississippi Products, Inc. Manufacturers of sewing machine and radio cabinets, furniture, veneer and panels. Visitors welcome on December 10, 11, 14, and 15. Contact Mr. John W. Squires.

Laurel-Hattiesburg-Wiggins, Miss.
U.S. 11, 49.

De Soto National Forest. Prescribed burning probably will be in progress in December. W. W. Ashe Nursery at Brooklyn; also a fire dispatching station. Many other interesting features. Contact rangers John T. Koen, Laurel; Joseph V. Zary, Hattiesburg; or Russell L. Chipman, Wiggins; Nurseryman G. F. Erambert can be contacted at Ashe Nursery.

Laurel, Miss.
U.S. 11, 84.

Masonite Corporation. Hardboard manufacturing plant and associated woodlands. Contact Mr. F. H. Montgomery for plant visit. Contact Mr. J. S. Olden for woodland field trips. Extensive cutting operations and timber stand improvement work.

Wiggins, Miss.
U.S. 49.

Newton Naval Stores Company. A naval stores processing plant. Nearby turpentine trees being worked by bark chipping with acid stimulation. Visitors welcome on December 11 or 15. Contact Mr. Robert M. Newton who will appreciate advance notice.

Gulfport Creosoting Company. Pole yard at Wiggins. Visitors welcome before 3:30 p.m. week days. Mr. J. A. Schilling will show visitors the yard Saturday or Sunday, December 15 or 16, if prior arrangements are made.

Northwest of Biloxi

Memphis, Tenn.
U.S. 61, 80.

Anderson-Tully Company. Extensive hardwood timberland ownership, logging operations, and mills. Contact Mr. W. E. Houser, P. O. Box 28, Memphis 1, Tenn., telephone 5-4404.

Stoneville, Miss.
U.S. 61.

Delta Experiment Station. U. S. Forest Service cottonwood plantings, preservative treatment of hardwood fence posts, bottomland hardwood management (improvement cuttings in stands of varying depletion, stand conditions ten years after an improvement cutting). Visitors welcome up to noon December 11 and after the meeting. Contact officer in charge.

Alexandria, La.
U.S. 71, 165, 167.

Alexandria Branch, Southern Forest Experiment Station. Palustris Experimental Forest, 20 miles southwest of Alexandria includes 500 acres of pine plantations established between 1934-1941. Numerous experiments in progress; timber and cattle production on cut-over pine land, chemical control of hardwoods, forage plant nursery. Half or full-day field trips will be scheduled but prior arrangements (before December 10) suggested. Write Southern Forest Experiment Station, 1015 Wisteria Street, P. O. Box 1192, Alexandria, La., or contact officer in charge, telephone 2-1983. Information can be obtained at this location as to other forestry activities in the vicinity, both on national forests and on industrial properties.

Natchez, Miss.
U.S. 61, 65, 84.

International Paper Company. A new dissolving pulp mill using hardwood by the sulphate process. Contact Mr. D. V. Logan, International Paper Company, Natchez, Miss.

Johns-Manville Products Corporation. An insulating board manufacturing plant and associated woodlands. Contact Mr. J. W. Thompson at Natchez, or Mr. Carl Hammarstrom at Bude, Miss. (35 miles east of Natchez on U.S. 84).

Meadville, Miss.
U.S. 84.

Homochitto National Forest. Fine development of a loblolly pine forest. Extensive timber sales in progress. Severe damage caused by ice storm January 31-February 1, 1951. Contact Ranger J. O. Kirby, Meadville, Miss. (Ranger station east of town on U.S. 84.) Prior arrangement desirable for trips.

Crosby, Miss.
Reached from Meadville or Natchez over local roads.

Crosby Lumber and Manufacturing Company. Large pine lumber mill, extensive timberland. Of special interest are portable sawmill operations. Write Mr. James R. Clark, Crosby, Miss., for directions and arrangements.

Candidates for Membership

Candidates for membership whose applications were received in the Society office prior to September 1, 1951 are listed below. Names, positions, addresses, and education are given.

Action regarding the eligibility of these candidates will be taken by the Council as of November 1, 1951. Comments, protests, or important information regarding the qualifications for membership of candidates listed are invited from present voting members. All such communications are kept strictly confidential being used only by the Council in taking final action on applications. Correspondence should be received in the Society office prior to November 1, 1951.

The names of those candidates who are elected will be published in the Society Affairs department of the December 1951 JOURNAL OF FORESTRY. The names of those who signify their acceptance of election will be published in subsequent issues of the JOURNAL.

Allegheny Section

Junior Grade

Antonis, J., 5641 N. 20th St., Philadelphia, Pa.; Pa. State, B.S.F., 1951.

Fox, M. F., 9th St., Freedom, Pa.; Pa. State, B.S.F., 1951.

Keiser, D. F., 24 Hawthorne Rd., West Lawn, Pa.; Pa. State, B.S.F., 1950.

Member Grade

Bandekow, R. J., Asst. Tech. Dir., Borden Co., N. J.; N. Y. State, B.S.F., 1941; Yale, M.F., 1942. (Junior, 1943).

Carpenter, C. H., c/o New York and Pa. Co., Lock Haven, Pa.; N. Y. State, B.S.F., 1929; M.F., 1931. (Junior, 36R47).

Johnson, J. E., R. D. No. 3, Spring Grove, Pa.; Univ. of Wash., B.S.F., 1945. (Junior, 1946).

Reigner, I. C., Forester, U.S.F.S., Upper Darby, Pa.; Pa. State, B.S.F., 1938; Duke, M.F., 1948. (Junior, 36R47).

Affiliate Grade

Strarsky, J., Maintenance Foreman, Styers Nurseries, Con-ordville, Pa.; Univ. of Munich, (Forest Economics), 1946.

Appalachian Section

Junior Grade

Mitchell, W. P., County Forester, N. C. Dept. of Cons., and Dev., Gastonia, N. C.; N. C. State, B.S.F., 1951.

Schwartz, C. M., Duke Univ., Durham, N. C.; Univ. of Conn., B.S., 1948; Duke, M.F., 1951. (Affiliate, 1951).

Central Rocky Mountain Section

Junior Grade

Klemmedson, J. O., Soil Cons., U.S.D.A., Monte Vista, Colo.; Univ. of Calif., B.S.F., 1950.

Member Grade

Dickison, F. F., Soil Cons., Nat'l. Park Service, Omaha, Nebr.; Colo. A & M., B.S.F., 1937. (Junior, 1947).

Central States Section

Junior Grade

Goodwin, D. K., 721 N. Wallace Ave., Indianapolis, Ind.; Purdue Univ., B.S.F., 1950.

Member Grade

Hudson, R. K., Asst. Prof., Forestry Dept., Mich. State College, East Lansing, Mich.; Mich. State, B.S.F., 1944; M.S., 1944. (Junior, 1944).

O'Connor, G. W., Asst. Supt., Forest Preserve Dist., River Forest, Ill.; Univ. of Idaho, B.S.F., 1943. (Junior, 1944).

Olson, G. E., Tech. Repre., Dow Chemical Co., Midland, Mich.; Univ. of Minn., B.S.F., 1940; Yale, M.F., 1941. (Junior, 1944).

Columbia River Section

Junior Grade

McCormack, M. H., Forester, U.S.D.I., Roseburg, Oreg.; Oregon State, B.S.F., 1940.

O'Keeffe, E. H., Forester, U.S.D.A., Corvallis, Oreg.; Oregon State, B.S.F., 1949.

Member Grade

Chriswell, H. C., Dist. Forest Rgr., U.S.F.S., Prospect, Oreg.; Univ. of Wash., B.S.F., 1935. (Junior, 1945).

Compton, L. M., Dist. Warden, Oregon State

Forestry Dept., La Grande, Oreg.; Oregon State, B.S.F., 1934. (Junior, 36R50).

Gulf States Section

Member Grade

Kowal, R. J., Sr. Ento., Forest Insect Lab., Gulfport, Miss.; N. Y. State, B.S.F., 1933; M.S., 1936. Reinstatement.

Inland Empire Section

Junior Grade

Muehlethaler, C. J., Rathdrum, Idaho; Univ. of Idaho, B.S.F., 1950.

Member Grade

Glaus, B. H., Civil Engr., U.S.F.S., Orofino, Idaho; Univ. of Mont., B.S.F., 1942. (Junior, 1947).

Intermountain Section

Junior Grade

Miller, R. L., Soil Cons., U.S.D.A., Idaho Falls, Idaho; Univ. of Idaho, B.S.F., 1951.
Simons, L. A., 458 W. 6th St., St. Anthony, Idaho; Utah State, B.S.F., 1951.

Member Grade

Daugherty, C. I., Forest Supv., U.S.F.S., Hailey, Idaho. (Junior, 1947).

New England Section

Junior Grade

Hopkins, H. E., North Eastham, Mass.; Univ. of Mass., B.S.F., 1951. (Student, 1951).

Member Grade

Breck, R. W., County Forester, Univ. of N. H., Milford, N. H.; Univ. of N. H., B.S.F., 1940; Yale, M.F., 1941. (Junior, 1941).
Lachance, P. E., Cons. Forester, 14 Place D'Aiguillon, Quebec, Canada; Laval Univ., B.A., 1937. (Junior, 1948).

New York Section

Junior Grade

Catalanotto, L. G., 101 Foxhurst Rd., Oceanside, N. Y.; State Univ. of N. Y., B.S.F., 1950.
Eckert, J. J., Jr. Forester, State of N. Y. Cons. Dept., Middletown, N. Y.; State Univ. of N. Y., B.S.F., 1950.
Franke, R. P., 380 E. 29th St., Brooklyn, N. Y.; State Univ. of N. Y., B.S.F., 1951.
Richardson, J. M., Leak Location Engr., Heath Tree Service, Inc., Wellesley, Mass.; State Univ. of N. Y., B.S.F., 1951.

Associate Grade

Connola, D. P., Sr. Scientist, State Univ. of N. Y., N. Y. State Science Service, Albany, N. Y.; Rutgers Univ., B.S., 1950.

Northern California Section

Junior Grade

Heilman, E. G., Forester, U.S.F.S., Trinity Center, Calif.; Mont. State, B.S.F., 1950.

Member Grade

Taylor, J. E., Dist. Rgr., U.S.F.S., Northfork, Calif.; Univ. of Calif., B.S.F., 1940. (Junior, 1944).

Northern Rocky Mountain Section

Junior Grade

Yahvah, E. L., Woods Scaler, J. Niels Lbr. Co., Rexford, Mont.; Colo. A & M., B.S.F., 1950.

Ozark Section

Junior Grade

Bammert, R. F., 6329 Pernod, St. Louis, Mo.; Univ. of Mo., B.S.F., 1951.

Member Grade

Bixby, T. P., Field Engr., U. S. Bureau of Reclamation, Ellis, Kansas; Univ. of Me., B.S.F., 1930; Yale, M.F., 1930. (Reinstatement).
Mann, W. F., Jr., Research Forester, U.S.F.S., Crossett, Ark.; Pa. State, B.S.F., 1937. (Junior, 1943R47).

Puget Sound Section

Member Grade

Williams, A. S., Forest Engr., 119 Pender St., W., W. Vancouver, Canada; Cornell Univ., F.E., 1903. Reinstatement.

Southeastern Section

Junior Grade

Barnes, R. L., 1836 N. W. 2nd Ave., Gainesville, Fla.; Duke Univ., B.S.F., 1950; M.F., 1951.
Douglas, F. L., Tbr. Mgr., Nat'l. Turpentine and Pulpwood Corp., Jacksonville, Fla.; Univ. of Fla., B.S.F., 1951. (Student, 1951).
Johnson, L. J., 4518 Astral St., Jacksonville, Fla.; Univ. of Fla., B.S.F., 1951. (Student, 1951).
Jones, F. E., Asst. Dist. Rgr., Gulf States Paper Corp., Columbiana, Ala.; A.P.I., B.S.F., 1950.
Parker, D. C., Asst. Forester, W. E. Belcher Lbr. Co., Centreville, Ala.; A.P.I., B.S.F., 1950.
Ray, W. A., Asso. Forester, W. E. Belcher Lbr. Co., Centreville, Ala.; A.P.I., B.S.F., 1950.
Rowe, R. H., Jr., Box 127, Madison, Fla.; Univ. of Fla., B.S.F., 1951. (Student, 1951).
Uhler, J. R., Milledgeville, Georgia; Univ. of Ga., B.S.F., 1948.

Member Grade

Dougherty, D. A., Forester, Waller and Durham, Blountstown, Fla.; Univ. of Fla., B.S.F., 1943. (Junior, 1944).
Wiley, H. M., Cruiser, Union Bag and Paper Corp., Savannah, Ga.; Colo. A & M., B.S.F., 1938. (Junior, 1936).

Affiliate Grade

Parker, J. M., Logging and Woodland Supt., Neal Lbr. and Mfg. Co., Blountstown, Fla.

Southwestern Section

Junior Grade

Dougherty, F. G., Forestry Aide, U.S.F.S., Winslow, Ariz.; Iowa State, B.S.F., 1950.
Neal, R. L., Jr., Forestry Aide, U.S.F.S., Holbrook, Ariz.; Oregon State, B.S.F., 1951.
Riddle, D. D., Forestry Aide, U.S.F.S., Holbrook, Ariz.; Iowa State, B.S.F. 1950.
Toft, G. W., Forester, U.S.F.S., Holbrook, Ariz.; Colo. A. & M., B.S.F., 1951.

Southern California Section

Junior Grade

Percey, R. W., Asst. Fire Warden, Los Angeles County Dept. of Forestry, Altadena, Calif. (Affiliate, 1939).

Upper Mississippi Valley Section

Junior Grade

Larie, E. G., Land Appraiser, U. S. Fish and Wildlife Service, Minneapolis, Minn.; Purdue Univ., B.S.F., 1948.

Washington Section

Junior Grade

Hobart, W. L., Asst. Dist. Forester, Md. Dept. of Forest and Parks, Laurel, Md.; Univ. of Mich., B.S.F., 1951.

Candidates Elected

The following persons were elected to the indicated grades of membership by the Council on September 1, 1951.

Junior Grade

Abarr, C. L.
Abrahamson, R. E.
Allen, M.R.
Andringa, J. J.
Arnold, P.
Assmus, C. W.
Bacon, C. A.
Bailey, E. E.
Bailey, H. J.
Baird, C. O.
Baker, D. H.
Ball, H. E.
Barnes, W. S.
Banusevich, F. J.
Bassett, J. R.
Bates, J. D.
Bates, S. J.
Bauer, T. J.
Baumgartner, L. F.
Baxter, H. O.
Beaman, J. H.
Beard, T. J.
Beatty, B. W.
Beavin, M. J.
Beckwith, O. D.
Belt, R. S.
Benedick, D. B.
Benfell, L. H., Jr.
Benson, H. W.
Bernardin, P. E.
Berndt, H. W.
Biddison, L. R.
Bigney, F. H.
Blickenstaff, B.
Blaser, R. A.
Blinks, S. E.
Blunt, E. F.
Bockes, O. D.
Bond, R. S.
Bones, W. F., Jr.
Borden, M. E., Jr.
Bosselman, H. H.
Brewer, T. M.
Bright, D. W.
Bronson, E. W.
Brooks, C. R.
Brown, D. L.
Brown, R. C.
Broyles, H. H.
Bryan, W. J.
Budreski, F. A.
Burnell, F. F.
Burns, F. H.
Burtchett, G. W.
Burton, K. L.
Burton, R. P., Jr.
Butler, W. E.
Cameron, G. P.
Campbell, D. C.
Campbell, D. G.
Campbell, J. M., Jr.
Cantelou, L. B.
Capell, J. R.
Caragozian, J. L.
Carlson, D. R.
Carmichael, R. L.
Carpenter, E. M.
Carroll, F. O.
Case, R. M.
Chamberlain, J. E.
Chandler, C. C.
Chapin, W. E.
Chapman, H. H.
Cherry, P. E.
Chick, H.
Christiansen, L. M.
Clocksin, D. B.
Coachman, L. K.
Coates, H. W.
Coffell, D. G.
Cole, R. M.
Collins, D. H.
Coltharp, G. B.
Condron, T. H.
Cook, F. T.
Cook, H. E.
Cook, W. B.
Corson, P. F.
Counts, V. J.
Cousins, C.
Cowley, I. C.
Coy, R. M.
Crabb, W. F.
Craft, E. P.
Craine, M. E.
Crosby, M. R.
Crossfield, F. E.
Crouch, J.
Crowell, S. F., Jr.
Cushman, H.
David, G. C., Jr.
Davidson, A. C.
Davila-Olivo, G.
Davis, G. D.
Dawson, F. S.
Deason, J. W.
DeGrummond, E. A., Jr.
Dewey, J. E.
Diez, C. M.
Dimock, E. J.
Dixon, A. C.
Douglass, J. E.
Duesing, R. C.
DeLaney, R. F.
Duysen, G. H.
Eaton, R. M.
Eberhart, J. A.
Eckstrom, T. F.
Edgington, R. C.
Egan, P. H.
Eisenmenger, R. W.
Emerson, J. L.
Emond, R. J.
Engel, J. E.
Enos, J. J.
Enslen, R. H.
Epstein, E.
Erikson, D. F.
Essex, B. L.
Estep, E. M.
Etchison, P. B.
Evans, P. A.
Evenson, A. L.
Feeney, C. R. T.
Fillmore, W. J.
Findell, V. E.
Finger, G. P.
Finnegan, J. E., (re)
Fisher, R. L.
Fisk, C. V., (re)
Fox, G., Jr.
Fritz, D. H.
Fry, D. H.
Fulton, P. A.
Funk, D.
Gamble, R. J.
Gay, J. E.
Geiger, H. W., (re)
Gentry, B. W.
Gilbertson, H. W., Jr.
Gockerell, E. C.
Godden, J. A.
Goodrich, D. S.
Goodrich, R. S.
Gordon, S. M.
Gorsuch, H. L.
Gould, N. E.
Gould, W. P.
Graham, D. A.
Graham, H.
Grayum, G. H.
Green, E. B.
Greenwood, L. D.
Grissom, H. S.
Grove, E. R., Jr.
Gullion, B. S.
Haas, R. E.
Hadley, D. L.
Haglund, H. L.
Haines, W. H. B.
Hall, J. L.
Hall, G. H., Jr.
Hallett, A. F. E., Jr.
Hance, J.T.
Haney, G. P.
Hansen, N. J.
Hanson, R.
Hargraves, J. F., Jr.
Harris, R. L.
Harrison, J. S.
Hawes, R. B.
Hawkes, L. E.
Hawley, J. H.
Heath, E. H.
Heiner, H.
Heim, R. E.
Henderson, J. H., Jr.
Henson, I. C.
Hermann, A., (re)
Herrington, R. B.
Hickerson, W. V. D.
Hill, J. L.
Hintz, R. J.
Hixon, F. T.
Holloman, E. A.
Holton, C. L.
Hope, D. G.
Horak, F. J.
Hubbe, G.
Hudson, H. H.
Hughes, T. T.
Hughes, W. C.
Huntemann, J. W.
Hursh, M. H.
Jeffrey, W. H.
Jensen, A. C.
Jensen, A. W.
Jenson, R. L.
Jewell, F. F.
Johnson, R. E.
Jones, W. V.
Jope, H. B.
Juhl, T. C., Jr.
Kalwarski, S. A.
Karnig, J.
Kearns, F. W.
Keller, R. C.
Kelley, F. G.
Ker, J. W.
Kilbreth, H. E., Jr.
Kipp, P. R.
Kissick, N. L.
Kistner, D. R.
Klein, P. L.
Komanetsky, M.
Kopecky, F. J.
Kowal, H. W.
Ladd, A. B.
Lahr, J. D.
Land, H. C., Jr.
Landon, P. E.
Lang, J. W.
Langdale, J. J., Jr.
Lantz, N. J.
Larson, A. G.
Lawrence, A. C.
Lawrence, W. T.
Lee, J. B., Jr.
Lellelid, H. R.
Litten, G. W.
Lock, R. H.
Long, M., Jr.
Looney, J. F.
Lord, W. B.
Lowe, W. B.
Luke, K. E.
Lundgren, A. L.
Lyle, E. S., Jr.
Lynd, H. C.
Lynn, A. D.
Lyon, R. E. A.
Mabry, J. D.
Mackie, P. S.

Mahany, H. L., Jr.
Maple, W. R.
Marti, D. W.
Martin, E. F.
Martindale, D. L.
Martinson, K. R.
Mason, R. L.
Maxey, C. A.
Maxon, C. E.
McAninch, C. D.
McArdle, R.
McCluskey, G. E.
McCollum, W. W.
McConnell, J.
McCue, R. H.
McDaniel, T. J., Jr.
McDonald, D.
McDonald, W. R.
McFarland, H. J.
McGregor, D. C.
McGregor, R. C.
McLean, N., Jr.
McLeary, F. J.
McLeod, C. J.
McMahon, R. O.
McMillan, F. W.
Meenan, C. D.
Meeuwig, R. O.
Merriam, R. A.
Merrill, H. C.
Miller, J. E.
Miller, J. F.
Miller, M. L., Jr.
Miller, M. M.
Minister, D. M., Jr.
Mitchell, H. W. (re)
Moore, F. W.
Moore, H. J.
Moore, R. A.
Morgan, D. W.
Morris, G. S., Jr.
Morse, W. K.
Mosar, M. A.
Mostaller, J. B., Jr.
Mueller, C. A.
Nachod, L. H.
Nelson, R. C.
Nervig, S. O.
Newkirk, B. R.
Nichols, J. O.
Nobis, R. S.
Noblet, J., C.
Nottingham, C. R.
Nye, W. K.
Oakes, C. W.
Oldroyd, R. W.
O'Leary, D. F.
Oliver, W. D.
Olson, A. H.
Orr-Ewing, A. L.
Ostrowski, P. F.
Ouellette, C. G.
Paddock, W. R., Jr.
Page, D. S.
Palmer, R. L.
Parsons, R. G.
Patterson, W. C.
Patton, D. L.
Payette, R. C.
Penland, R. F.
Perash, J. H.
Peters, D. M.
Peterson, A. A.
Peterson, D. W.
Peterson, T. A.
Pierce, S. G.
Plourde, W. L.
Poe, C. M.
Poppe, C. R., Jr.
Post, A. J.
Powell, A. W.
Prausa, R. L.
Prentice, W. W.
Price, J. E.
Prigge, A. A.
Proctor, J. C.
Quadro, F. E.
Reese, J. L.
Rehbein, D.
Reid, J. R., Jr.
Reynolds, G. L.
Rhodes, J. W.
Rice, R. M.
Richards, J. R.
Richardson, W. A.
Rickman, S. H.
Rinehart, D. E.
Rising, R. P.
Roberts, H. H.
Roder, D. C.
Rolston, K. S., Jr.
Ross, G. L. R.
Rosaheim, J. D.
Roth, P. L.
Rouse, W. R.
Rowe, R. W.
Ryder, J. D., Jr.
Sader, D. A.
Sander, I. L.
Sandhusen, W. H.
Schaufler, P. G.
Schmidt, F. D.
Schmidt, A. N.
Schock, J. H.
Schoening, J. R.
Scholtes, W. E.
Schrager, M. H.
Seed, G. K.
Sharp, C. B.
Sharpe, G. W.
Sheek, R. N.
Sheppard, W.
Shilling, G. E.
Shogren, P.
Shriver, T. J.
Sibley, R. C.
Sliney, W. J., Jr.
Smith, D. W.
Smith, D., Jr.
Smith, H. W., Jr.
Smith, R. L.
Smart, E. F.
Snow, G. H.
Sohaney, A. L.
Sorensen, C. S. K.
Spencer, J. V.
Spencer, L. D.
Springer, C. J.
Stacy, W. R.
Stahl, M. K.
Stambaugh, W. J.
Stang, D. A.
Stanley, F. B., Jr.
Stark, K. S.
Stevens, G. M.
Stockman, J. F.
Stockton, A. L.
Straka, P. R.
Strand, R. F.
Strang, J. H.
Stuckey, W. N., Jr.
Sullivan, M. J.
Sulskis, A.
Summerfield, E. R.
Sundin, P. A.
Sutherland, K. I.
Sweetland, T. W.
Swift, C. S.
Tallia, G. J.
Tanner, R. S.
Taplin, A. D.
Taylor, T. A.
Terry, D. C.
Theuerkauf, E. H.
Thompson, T. A.
Thompson, W. S.
Thorton, D. L.
Tindall, R. W.
Tissue, O. C.
Todd, W. G.
Toland, J. R. S.
Toler, B.
Torgerson, K. G.
Trew, I. F.
Tucker, J. C.
Turner, W. H.
Tuttle, R. A.
Twombly, A. D.
Underwood, E. H.
Upper, R. B.
Urie, D. H.
Vander Cook, L. S.
Vander Sys, J. T.
Van Gieson, B. R.
Vernam, W. C.
Vick, T. B.
Viele, D. H.
Vogel, D.
Walker, E. B.
Walters, R. S.
Walton, S. A.
Wanek, J.
Weidner, R. G.
Welch, G. D.
Wellinger, F. R.
Wells, D. P.
Wells, S. N., Jr.
West, R. A.
Westbury, H. M.
Wiese, R. F.
Wilkinson, W. B.
Willett, D. V., Jr.
Williams, D. N.
Williams, R. J.
Williams, T. D.
Willis, A. C.
Wills, W. W.
Willoughby, C. C.
Wilsky, H. F.
Wood, M. S.
Woodall, E. A.
Zepeda, H. A.
Ziegler, R. C.
Zitkovich, S. J.

Member Grade

Hatle, O. J. — Hill, F. S.; Yorman, A. J.

Affiliate Grade

Bayles, W. P. — Moody, H. W.
Lilley, J. R. — Smith, J. T.
McKee, J. R. — Waller, D. B.

Associate Grade

Berner, L. M. — Kurth, E. L.; Stevens, B. M., Jr.

New Members and Advancements

The new members and members who have been advanced in grade who are listed below are eligible for participation in activities of the Society of American Foresters, including the meetings and projects of Sections, Chapters, Divisions, and Committees. They have submitted their applications for membership, properly endorsed, and have been declared eligible by the Council. By accepting election these members have indicated their desire to assist the Society in the fulfillment of its objectives.

Allegheny Section

Junior Grade

Berthy, H. P., Berkeley Springs, W. Va.

Member Grade

Smith, G. E., Millica Hill, N. J.

Affiliate Grade

Keaton, G. E., Pipestem, W. Va.

Appalachian Section

Junior Grade

Ference, G. M., 880 Louise Circle, Durham, N. C.
Marlow, E. G., 302 Kelley St., Kingstree, S. C.
Reames, W. H., Box 50, McClellanville, S. C.

Member Grade

Billingsley, J. C., 924 Fair St., Newberry, S. C.
Bishop, H. F., 305 Harmon Park Rd., Marion, S. C.
Greene, G. E., S. E. Forest Exp. Sta., Asheville, N. C.
Lehocky, A. A., Box 357, Columbia, S. C.

Associate Grade

Copeland, O. L., Jr., 307 Lakeview Heights, Union, S. C.

Central Rocky Mountain Section

Junior Grade

Caudill, R. L., Jr., Box 797, Lander, Wyo.

Member Grade

Stadler, G. S., 370 Clayton St., Denver, Colo.

Central States Section

Student Grade

UNIVERSITY OF MICHIGAN

Jones, R. A.

Junior Grade

Bacon, B. C., Jr., 2409 Shrader Ave., New Albany, Ind.
Brendenmuehl, R. H., F.P.H.A., 224-2 West State St., Lafayette, Ind.
Nye, J. W., Elkhart, Ind.

Member Grade

Byrd, J. M., Avon Place, Athens, Ohio

Affiliate Grade

Easley, A. H., Brownstown, Ind.

Associate Grade

Compton, L. F., 148 E. Clinton Heights, Columbus, Ohio

Columbia River Section

Junior Grade

Garey, C. A., 570 27th Ave., Longview, Wash.
Golding, A. G., U.S.F.S., Foster, Oreg.
Stoebig, R. W., 350 Kourt Drive, Eugene, Oreg.

Member Grade

Gillmor, L. G., Blue Mountain Rgr. Sta., Unity, Oreg.
Olin, D. D., 1224 N. W. Conklin Ave., Grants Pass, Oreg.
Seymour, L. H., Box 231, Scio, Oreg.

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Wall, S. R.

Junior Grade

Burkhardt, E. C., Vicksburg, Miss.
Clark, H. D., Jr., Box 682, Winner, La.
Dunford, H. V., 1404 Maple St., Winnfield, La.
Lafitte, W. E., c/o Keith Cranston, Leland, Miss.
Loveless, C. M., Box 717, Clinton, Miss.
Strauss, R. H., 1121 S. First St., Lufkin, Texas

Member Grade

King, W. W., 911 S. 3rd St., Lufkin, Texas

Affiliate Grade

Darsey, F. E., Box 386, Arcadia, La.
Davis, B. H., Taylor, La.
Delaney, L., Woodworth, La.
Dickerson, H. C., Box 348, Kilgore, Tex.
Parsons, M. B., Dist. Rgr., Wiggins, Miss.
Tyson, R. L., Box 823, Minden, La.

Inland Empire Section

Junior Grade

Hakenson, C. G., Newport, Wash.

Intermountain Section

Member Grade

Bradshaw, J. R. J., 55 N. 100 W., St. George, Utah
Winkler, O. E., 320 E. 7th N., Logan, Utah

Kentucky-Tennessee Section

Junior Grade

Hawkins, W. Z., 1623 Monroe Ave., Memphis, Tenn.

New England Section

Affiliate Grade

Kienholz, J. B., 2 Stanton Ave., Norwich, Conn.

New York Section

Junior Grade

Croom, N. P., 59 Elting Ave., New Paltz, N. Y.
Hill, J. A., 102-41 90th Ave., Richmond Hill, N. Y.
Rosasco, E. M., N. Y. State College of Forestry, Syracuse, N. Y.

Member Grade

Parmelee, S. R., Tupper Lake, N. Y.

Northern California Section

Junior Grade

Maule, W. M., U.S.F.S., Alturas, Calif.

Member Grade

Burns, R., 1655 Los Robles Blvd., N. Sacramento, Calif.
Merrill, A. H., Box 525, Samoa, Calif.

Associate Grade

Van Rensselaer, M., Saratoga Exp. Gardens, Saratoga, Calif.

Northern Rocky Mountain Section

Junior Grade

Leaphart, C. D., Div. of Forest Path., Missoula, Mont.

Member Grade

Mart, R. M., River Rd., Missoula, Mont.

Ozark Section

Junior Grade

Hester, J. E., Daisy Rte., Kirby, Ark.
Hyatt, W. G., 4001 Washington, St. Louis, Mo.
Schwietzer, F. J., Jr., Hot Springs Nat'l. Park, Hot Springs, Ark.
Shelton, R. K., Dist. Forester, Stamps, Ark.
Techannen, L., Box 382, Steelville, Mo.

Member Grade

Rawls, I. W., Box 272, Crossett, Ark.

Affiliate Grade

May, L. C., Box 390, Huttig, Ark.
Peebles, E. G., Bethel Route, Broken Bow, Okla.

Puget Sound Section

Junior Grade

Dahlgreen, A. K., Star Route, Entiat, Wash.
Furr, W. C., U.S.F.S., Darrington, Wash.
Grette, O. C., South Bend, Wash.
Johnson, A. L., U.S.F.S., Juneau, Alaska

Member Grade

Rochelle, E. B., Box 97, Omak, Wash.

Affiliate Grade

Merridith, W. K., Sappho, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF GEORGIA

Harper, R. W.
Kreis, E. A.
Lancaster, J. K.
Livingston, G. M., Jr.
Macrigeanis, S. N.
Matthews, H. W., Jr.
Rodgers, M. F.

Junior Grade

Anderson, C. W., 216 Margaret St., Jacksonsonville Beach, Fla.
Cook, D. R., General Delivery, Centerville, Ala.
Goodwin, J. C., Jr., Box 403, DeLeon Springs, Fla.
Koier, W. L., Jr., 1330 N. 24th St., Birmingham, Ala.
Pearce, N. D., Hamilton, Ala.
Rainer, Y. W., Box 61, Ozark, Ala.
Reed, A. V., 108 Houston Drive, Bessemer, Ala.
Reed, J. O., 1526 3rd Ave., Columbus, Ga.
Starling, W. B., Box 61, Ozark, Ala.

Member Grade

Carruth, H. C., Woodlands Dept., Coosa River Newsprint Co., Coosa Pines, Ala.
Dietterich, C. W., 1456 Sheridan Circle, N. E., Atlanta, Ga.
Kilgore, W. E., 901 Airport Rd., Jasper, Ala.

Southern California Section

Junior Grade

Wood, H. J., 1720 Cedar Ave., Long Beach, Calif.

Southwestern Section

Junior Grade

Kite, J. A., Jr., U.S.F.S., Silver City, N. Mex.

Affiliate Grade

Bassler, C. D., Box 1053, Flagstaff, Ariz.
Hunt, A. C., c/o Southwest Lbr. Mills Inc., McNary, Ariz.

Upper Mississippi Valley Section

Junior Grade

Rowe, R. W., Belmont Apts., Hibbing, Minn.

Member Grade

Gannaway, J. C., 339 State Office Bldg., St. Paul, Minn.
Thomson, G. W., 224 Howard Ave., Ames, Iowa

Washington Section

Junior Grade

Seiser, V. O., Cabin John, Md.

Associate Grade

Ellis, Agnes M., 1466 Columbia Rd., N.W., Washington, D. C.

Wisconsin-Upper Michigan Section

Junior Grade

Christianson, E. M., 409½ North Pier, Merrill, Wisc.
Katovich, A., 321 Wyatt Ave., Wisconsin Rapids, Wisc.
Seglund, R. O., 311 W. Superior St., Munising, Mich.
Taube, A. H., Rgr. Sta., Wausaukee, Wisc.

Member Grade

Korotev, J. R., 1369 Portier St., Green Bay, Wisc.
Limpert, C. E., Box 71, Hermansville, Mich.

Affiliate Grade

Knapp, C. A., c/o Forest Protection Headquarters, Tomahawk, Wisc.

Foreign

Junior Grade

Lyons, T. F., Firestone Plantations Co., Cape Palmas, Liberia, Africa

Deadline Near for Consultant Listing

Consulting foresters who wish to have their names included in the Society's January 1952 List of Consulting Foresters should apply to the Society office prior to November 1, 1951.

Consultants applying for listing should provide name, address, territory, and specializations, following the form used in the last list which was published in the January 1951 JOURNAL OF FORESTRY.

Consultants whose listings appeared in the previous compilation and who have not yet returned inquiry cards received in September should do so at once.

Annual Meeting Hotel Reservations

This reservation coupon is for your convenience in requesting your hotel room. Please send your request to the committee to avoid delay and confusion. Room assignments will be made promptly, and you will receive a confirmation in two weeks or less.

A member who desires to make a reservation without tearing this page from the JOURNAL may do so simply by supplying the pertinent information in a letter addressed to the committee.

The Buena Vista Hotel is the headquarters for the meeting. However, because of the expected large attendance, the Buena Vista cannot accommodate all members. Consequently, other hotels in Biloxi and along the Gulf Coast will cooperate in housing members.

Please consult your September JOURNAL, pages 667-8, for room rates.

A schedule of annual meeting events appears on page 750 of this issue.

Hotel Reservations Committee
Society of American Foresters
Buena Vista Hotel
Biloxi, Mississippi.

....., 1951
(Date)

Please reserve the following room accommodations for arrival on December ..... a.m. p.m. Departure date, December .....a.m. p.m. I understand that accommodations will be provided at the rate desired, if available; otherwise the next nearest rate will apply.

..... Single room with bath. Rate $.....
..... Double-bed room with bath. Rate $.....
..... Twin-bed room with bath. Rate $.....
..... Room with 3 beds and bath. Rate $.....
..... Room with 4 beds and bath. Rate $.....
..... Two bedrooms with bath between. Rate $..... per room.
..... Suite (parlor, twin-bed room, and bath). Rate $.....
..... Other (specify accommodations wanted). .....
..... Rate $.....
..... Tourist court (specify accommodations wanted). .....
..... Rate $.....
..... I expect to travel by automobile. (Not to be checked by those who will use other kinds of transportation.)

The above room accommodations are requested for the following persons, in addition to myself. (Please type or print legibly.)

.....
.....
.....
.....

My Name: .....

Street Address: .....

City, Zone, State: .....

Forestry News

Holsoe Takes Liberia Post

Torkel Holsoe, professor of silviculture, Forestry Division, University of West Virginia, has been granted a year's leave of absence to work in Liberia, in the Technical Cooperation Administration's forestry program there.

Torkel Holsoe

Prof. Holsoe has received also a Fulbright award for a 6-month period of research study in Norway. His trip to Liberia will not permit him to accept the award this year, however.

In his work in Liberia, he will be associated with Dr. C. R. Orton, former dean of the university's College of Agriculture, Forestry, and Home Economics, who is director of research and extension in that country under T.C.A.

Mr. Holsoe will serve as an adviser to Liberian technicians and country officials in the development of a research program, and give special attention to management and utilization of Liberian forests.

E. N. Munns Retires

Edward N. Munns, since 1937 chief of the Division of Forest Influences in the U. S. Forest Service, retired August 31 after more than 39 years' service.

An authority on watershed management Mr. Munns served on the staff of the President's Water Resources Policy Commission last year. He has served as vice-president of the International Union of Forest Research Organizations and on the land committee of the Interstate Commission on the Potomac River Basin. He is a Department of Agriculture representative on the Federal Inter-Agency River Basin Hydrologic Subcommittee, and is technical adviser on watershed management problems to the American Water Works Association. In 1947 he was a member of the Food and Agriculture Organization's rehabilitation mission to Poland.

Mr. Munns came to Washington in 1923 as chief of Forest Service experiment stations. In this capacity he helped in the planning of the shelterbelts of the mid-west in 1930's. In a follow-up study of the project in 1946 he advocated their maintenance and made recommendations for improvements.

Since entering the Forest Service in 1912 Mr. Munns has initiated and directed many studies in silvics and watershed management. For 9 years he was director of the Converse Experimental Station in California, where he made studies of the forest resistance of eucalyptus trees and studies of the effects of chaparral on streamflow.

Between 1921 and 1923 he worked for the State of California developing plans for protecting the headwaters of streams to reduce floods.

A native of St. Louis, Mo., Mr. Munns received his B.S. and M.F. degrees from the University of Michigan. He is chairman of the Washington section of the Soil Conservation Society of America and a Fellow in the Society of American Foresters.

He has written numerous articles for scientific, forestry, and timber trade journals on watershed studies, reforestation, and the relations of climate, soil, and streamflow to forests.

Schoen Named to Pulp and Paper Post

Paul W. Schoen, who for the past six years has served as executive secretary of the Forest Farmers Association, with headquarters in Valdosta, Ga. became Washington representative of the American Paper and Pulp Association and the American Pulpwood Association on September 1.

A native of Scranton, Pa., Schoen completed his public school education in that city before attending the Pennsylvania State Forest School at Mont Alto, Pa., where he received his degree in forestry in 1924. He taught in the North Scranton Junior High School for several years and then served in New York and Pennsylvania as a scout executive for the Boy Scouts of America.

In 1933, he re-entered forestry as a camp superintendent and forester for the Civilian Conservation Corps. In 1936, he was appointed forester for the New York Worlds Fair.

Paul W. Schoen

In 1937 he became chief of the division of silvicultural research for the Texas Forest Service, and in 1940, he was named chief of the division of forest management, in which capacity he served until he was appointed executive secretary of the Forest Farmers Association.

Harr Appointed Assistant Forester, West Virginia

West Virginia's conservation commission has announced the promotion of H. Milton Harr from the position of field assistant to the post of assistant state forester in charge of forests. In his new position he will have direct supervision of the operation of all state forests. The appointment, effective July 1, filled the vacancy caused when Hays Hemlick recently was promoted to the position of state forester.

New Fire Equipment Catalog

A new 108-page catalog of fire prevention and fire-fighting equipment has been issued by W. S. Darley & Company, 2810 Washington Boulevard, Chicago 12, Ill. Listing 1,100 items, 750 of which are shown by illustrations, the magazine-size booklet, *No. 146 Fire Equipment Catalog* is available free of charge to forest fire officials and firemen.

William M. Palmer Named Assistant Louisiana Forester

William McDavid Palmer has been appointed assistant state forester of the Louisiana Forestry Commission. Having served with the commission as a branch chief until 1948, Palmer returns to the organization after teaching for three years at Louisiana State University.

Palmer will coordinate all commission activities under State Forester James E. Mixon. A native of Louisiana, Palmer received his undergraduate education at Northwestern State College in Natchitoches, La., and at Louisiana State University. After receiving his B.S. in forestry at LSU, he went to the University of Michigan where he received his master's degree in 1938.

He began his forestry experience with the Colfax Lumber and Creosoting Company, but left after a few months to become a member of a forest survey party with the U. S. Forest Service in California. From there he took a job as field assistant with the Southern Forest Experiment Station in New Orleans.

In 1938, Palmer entered the service of the New England Timber Salvage Administration. Later, he was employed on the Kisatchie National Forest.

In 1941, he joined the Louisiana Forestry Commission as forest fire inspector. Later he served as assistant chief of fire control and chief of management. He left the commission in 1948 to accept the position of associate professor of forestry at LSU.

Wisconsin Community Forests

Wisconsin has 300 registered school and community forests with a total area of 53,208 acres owned by school districts, villages, towns, cities, counties, and organizations. The areas do not include the county forests under the forest crop law. The community and school forests have the active aid of the conservation department and receive free trees for planting.

The city of Superior recently set up 4,500 acres as a city forest to become the largest city forest in the state. About three-fourths of this area is already well wooded. Thirty-three of the state's 71 counties now have school forests. Rusk county has 36 school forests. Oneida county has 1,940 acres of school forest land. A total of 46 communities have forests apart from the school forest development.

1. *Headquarters reports illegal deer kill to warden on location.*

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2. Warden radios near-by warden for help.

3. Wardens close in—confirm hunters' phrase about 2-way radio, "You can't get away with it."

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AFPI Adds Forester to Staff

Theodore H. Davis, district forester for the Champion Paper & Fibre Co., Canton, N. C., has been added to the staff of American Forest Products Industries as a forester

James C. McClellan, for five years a forester for AFPI, has been promoted to the position of chief forester.

Theodore H. Davis

Prior to his work with Champion, Mr. Davis was in charge of the field office of the Central States Forest Experiment Station at Urbana, Ill. Before the war, he was assistant state forester of Indiana, in charge of fire protection and administration of the forest tax law. He enlisted in the Army Air Force during World War II as a second lieutenant and was released from active duty as a major.

The new AFPI forester will help promote the American Tree Farm System and the Keep America Green fire prevention program. He is a graduate of the New York State College of Forestry at Syracuse, with a degree in forest utilization.

Red Cedar Booklet

Where to Use Western Red Cedar Lumber, a new 16-page species booklet, has just been published by the West Coast Lumbermen's Association. Many uses of this wood, noted for its durability and beauty, are described in detail. Included is a grade use guide for the more generally used items.

The profusely illustrated booklet is printed in two colors. Copies are available without charge from the West Coast Lumbermen's Association, Portland, Ore.

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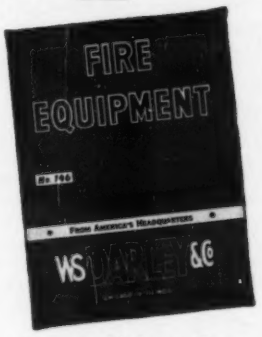

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Alaska Pulpwood Sale Completed By U. S. Forest Service

The largest sale of national forest timber ever made was completed, July 27, by the U. S. Forest Service in awarding a final contract for 1,500,000,000 cubic feet of Alaskan pulptimber to Ketchikan Pulp and Paper Company, Bellingham, Wash. The timber, sufficient to supply a pulp mill of 500-ton daily capacity for 50 years, is located on the Tongass National Forest in southeast Alaska.

Terms of the contract require the purchasers to construct a pulp mill of at least 300 tons daily capacity in Alaska. It is estimated that the plant will employ 800 persons when installations are completed. Site for the mill has already been acquired at Ward Cove near Ketchikan.

The sale is the result of 30 years of effort on the part of the Forest Service to bring the pulp and paper industry to Alaska. A comparable sale and development was on the point of completion when it was blocked by the depression of the early thirties. The Ketchikan development marks the first step in the opening up of the territory's huge pulptimber resource, the largest untapped resource of the kind on the continent. It is expected to play an important role in expanding the economy of the territory.

Forest Service officials state that this is probably the first of several pulpmills that may be later constructed to utilize the vast timber resources of the Tongass National Forest. They estimate that sufficient timber is available to support 5 or 6 mills of similar size.

Provisions of the timber sale agreement include handling of the timber on a sustained-yield cutting plan, safeguarding of salmon spawning streams, prevention of pollution, and preservation of the significant scenic values.

The sale was made on the basis of a 50-year cutting contract expiring June 30, 2004 and the company agreed to pay 85 cents per 100 cubic feet for timber cut for manufacture of pulp prior and up to July 1, 1964. For trees intended for manufacture or sale in other forms than pulp or pulp products, such as veneer logs or sawlogs cut in the same period, it agreed to pay $3 per thousand board feet for spruce sawlogs, $1.50 per thousand for cedar, and $2 per thousand for sawlogs of hemlock and other species. After July 1, 1964, and at subsequent five-year intervals, these rates, as provided by the contract, will be reappraised by the Forest Service.

The bulk of the timber covered in the bid is on the northerly portion of Prince of Wales Island. It is 75 percent hemlock and the balance mainly Sitka spruce with some small amounts of Alaska and western cedar.

Booklets on Lumber, Paper Manufacture

Of interest to educators and conservationists are two new publications by American Forest Products Industries.

The booklets, *The Story of Lumber and Allied Products* and *The Story of Paper,* explain, in terms the layman can understand, steps in the manufacture of various forest products. Each booklet is 16 pages, fully illustrated.

The paper booklet contains a "flow chart," which shows the paper-making process from the forest to the finished rolls of paper. A map in both publications shows the principal forest areas in the United States. Selective cutting, tree planting, and fire prevention are described in the booklets. Copies are available free from American Forest Products Industries, 1319 Eighteenth Street, N. W., Washington 6, D. C.

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ANNOUNCING

Trees of the Western Pacific Region

by J. HUGO KRAEMER, PH.D.

Associate in Forestry, Agricultural Experiment Station, Purdue University, Lafayette, Ind.

The region in which the trees described in this book are found includes Burma, the Malay Peninsula, Thailand, Sumatra, Java, Borneo, French Indo-China, Hainan, Formosa, Philippine Islands, Celebes Islands, Molucca Islands, Bismarck Archipelago, New Guinea, and the Solomon Islands.

This is the first time that botanical descriptions, illustrations, and descriptions of the woods of these trees have been made available in American Literature. The trees described are all readily available at low elevations and are widely distributed within the region. Their woods have desirable characteristics for a wide variety of uses and many are of present or potential commercial value. The descriptions are brief, highly technical terms are avoided and all useful information is included. The tree descriptions include botanical names, local names (native and trade names), habit, leaves, flowers, fruit, bark, wood (description, durability, uses, etc.), and environmental and geographic occurrence. Most species are accompanied by detailed drawings of the leaves, flowers and fruit. Other sections of the book include information on the collection of samples in the field, thatch materials available in the region, strength of wood (including tables of strength values for many of the woods of the trees described), and durability of wood.

This book is unique in American literature. It will prove invaluable to foresters, botanists, importers of foreign woods, and to any organization concerned with the use of native woods for construction purposes in this part of the World.

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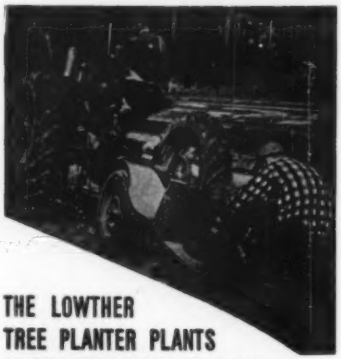

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Forestry Winners to Attend F.F.A. Convention

Continuing a policy to encourage rural leadership, the state winners in the cooperative Future Farmers of America forestry program from Virginia, North Carolina, South Carolina, Georgia, Florida, and Alabama will receive all expense trips to the

WARREN T. WHITE, assistant vice president of the Seaboard Air Line Railroad, presents a certificate of merit and a check to Hugh Vincent, Jr., Virginia's 1951 state forestry winner. G. W. Nichols, vo-ag teacher looks on.

national F.F.A. convention to be held at Kansas City, Mo., October 8 to 11, according to Robert N. Hoskins, industrial forester of the Seaboard Air Line Railroad Company. This program is now in its seventh year and students of vocational agriculture have been recognized throughout the Southeast for their work in forestry. District winners are given cash awards and are eligible to compete again in the Seaboard's forestry contest. This continuity of project work is resulting in greater diversification and scope of work.

State forestry winners to be honored this year are: Hugh Vincent, Jr. of Newsoms, Va.; Charles Dagenhart of Scotts, N. C.; Earl Berry of Saluda, S. C.; Alton Tanner of Nicholls, Ga.; Gail House of Gordo, Ala.; and William S. Fish of Taylor, Fla.

The vocational agriculture teachers of the top forestry winners are: G. W. Nichols of Newsoms, Va.; J. L. Crawford, Scotts, N. C.; Boyce Todd, Saluda, S. C.; Fred Shaw, Taylor, Fla.; Stanton Meeks, Nicholls, Ga.; and F. B. Killough, of Gordo, Ala.

Forest Fires in Missouri

A new bulletin, *Forest Fires in Missouri*, has been issued by the Missouri Conservation Commission, Jefferson City. It deals with causes, methods of suppression, and with the state's forest fire laws.

George Stewart to Assist Iran

Dr. George Stewart, range and forestry agronomist for the U. S. Department of Agriculture for more than 20 years, has been assigned to a Point Four technical cooperation assignment in Iran. The appointment was made at the request of the Government of Iran and in cooperation with the Technical Cooperation Administration, Department of State.

In 1949, Dr. Stewart was a member of a group of 26 United States consultants who assisted the government of Iran in developing plans for its program of agricultural development.

Before joining the U. S. Forest Service in 1930, he was an agronomist at the agricultural experiment station, Utah State Agricultural College for 13 years. A native of Tooele, Utah, he received his B.S. degree from Utah State Agricultural College in 1913, his M.S. from Cornell University in 1918, and his doctor's degree in agronomy from the University of Minnesota in 1926.

Dr. Stewart is the author of numerous publications and articles dealing with arid-region agriculture. In May of this year he received the Academy of Science, Arts and Letters' 1951 award for Service in Science.

Long-Bell Motion Picture Tells Industry History

The story of the lumber industry is told in a new sound and color motion picture released by The Long-Bell Lumber Co. The picture, which was recently taken at the Long-Bell operations in the South and along the Pacific Coast on 16 mm film, is designed to acquaint lumbermen and laymen with lumbering from the growing and harvesting of trees to the manufacture and use of products.

Entitled *Tree to Trade,* the motion picture devotes a short sequence to the history and growth of the 76-year old company and then takes the viewer into the plantations of the South and Pacific Northwest; into the logging camps of California, Washington, and Oregon; through one of the world's largest sawmills; illustrates the manufacture of many lumber products and closes with scenes in an average lumber yard with a salesman making a sale. The 31-minute film is available for use by the general public.

Tree to Trade has received an award for merit in Seattle and has been selected by the U. S. Department of State for inclusion in an informational packet of industrial films for projection abroad. The film is being distributed from the Kansas City, Mo., and Longview, Wash. offices of the Long-Bell Co. without charge.

N. C. Brown Named Professor Emeritus

Prof. Nelson C. Brown, who retired in June after 34 years on the faculty at State University College of Forestry, Syracuse, N. Y., has been named Professor Emeritus of Forest Utilization at the college. The honor was voted by the board of trustees at their semi-annual meeting in Syracuse on July 31.

Prof. Raymond J. Hoyle, a colleague of Prof. Brown for 30 years, was named acting head of the Department of Forest Utilization. A native of Glastonbury, Conn., Prof. Hoyle received his B.S. from the College of Forestry in 1917, and M.S. from Syracuse University in 1930.

He was appointed instructor in forest utilization in 1918, was promoted to assistant professor in 1924, associate professor in 1937, and professor in 1950. Prof. Hoyle directs the College's wood utilization service, which assists more than 2,000 New York timber owners, operators, and buyers in problems of manufacture, sale, and purchase of forest products.

Dr. Eric A. Anderson, a native of South St. Paul, Minn., was appointed acting head of the Department of Wood Technology at the meeting. He succeeds the late Dr. Harry P. Brown, who died May 24.

Dr. Anderson served with the U. S. Forest Service for 13 years before being appointed to the college faculty in 1950. He was with the Forest Products Laboratory, Madison, Wis., from 1942-1950.

Don Romano Retires

Retirement of Don E. Romano after serving 30 years in the U. S. Forest Service has been announced by C. J. Olsen, regional forester, Ogden, Utah. "For the past 14 years Romano has been a member of the regional office staff," Olsen stated, "serving in the divisions of timber management and operation and for the past 10 years in the division of personnel management."

Mr. Romano began his career as a forest ranger on the Minidoka National Forest in Idaho in 1921. He transferred to the Salmon National Forest as a ranger in 1922 and became assistant supervisor of that forest in 1927.

He completed his work for a degree in forestry at the University of Michigan in 1927.

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W. J. Baker (1900-1951)

William Jennings Baker, 50, chief of research for the Oregon forest products laboratory at Oregon State college, died in Portland, August 10.

Widely known in the forestry research field, Baker was placed in charge of the Oregon forest products laboratory in Corvallis last April, following the recall of Dr. P. B. Proctor to the armed services.

He was born at Bonner, Mont., December 25, 1900. He attended Oregon State college, receiving his bachelor's degree in forestry in 1927 and his master of science degree in 1928.

After working for a number of forest products companies in the Northwest, he became assistant professor of forestry and head of the department of lumber manufacture in the OSC school of forestry in 1930. He was later placed in charge of the department of wood products.

Professor Baker left OSC in 1936 to join the faculty of the school of forestry at Michigan State college. In 1941 he became a technologist for the U. S. Forest Products Laboratory at Madison, Wis., where he conducted training courses for military personnel. In the latter part of the war he was made chief of the technical service training division which gave technical instruction to more than 16,000 persons.

He returned to OSC in 1947 as chief of research for the forest products laboratory.

Oregon Foundation Elects

H. J. Cox, Eugene lumberman, was re-elected president of the Oregon Forestry Research Foundation at the annual meeting of the organization held in Portland, July 30. Paul M. Dunn, dean of the Oregon State College School of Forestry, was re-named secretary-treasurer.

E. B. MacNaughton of the First National Bank of Portland, Cox, and Dunn were chosen as directors for additional 3-year terms. Other directors now in service are B. V. Hancock, Cascades Plywood Corporation; Paul Neils of the J. Neils Lumber Company, Edmund Hayes, lumberman, all of Portland, and Floyd Hart of the Forest Products Company of Medford.

The foundation, a non-profit corporation organized in 1945, serves as a repository for donations, grants, and cooperative funds and an intermediary agency to facilitate forestry research projects with the Oregon Forest Products Laboratory and Oregon State College.

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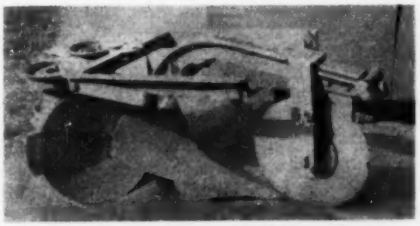

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Forest Named for E. O. Siecke

E. O. Siecke, who served as head of the Texas Forest Service for 25 of its 36 years, was honored on July 18, when a state forest near Kirbyville was dedicated in his name.

Mr. Siecke served as state forester from 1917 to 1942. Prior to 1917 he was deputy state forester of Oregon and served on the faculties of the Oregon Agricultural College and the State College of Washington. He was also employed by the U. S. Forest Service for four years.

The forest dedication coincided with the annual forestry camp for FFA and 4-H Club boys, sponsored jointly by the Texas Forest Service and the Texas Foresty Association, held in the E. O. Siecke State Forest.

E. O. Siecke

The dedication ceremonies were held in a pine plantation established in 1926 under the direction of Mr. Siecke on the 1722-acre state forest. The inscription on the dedication plaque reads:

This forest, devoted to research and demonstration of commercial timber growing, is named in honor of E. O. Siecke, a pioneer forester and for 25 years director of the Texas Forest Service, Texas A&M College System.

In recognition of Siecke's contribution to the advancement in forestry conservation in wise use, the Texas Forestry Association places this plaque and hereby restates its dedication to an economy of timber abundance for present and future Texans.

New Forest Fire Training Film

Campaign Fire is the title of a California Division of Forestry training film on large fire organization.

The film outlines the factors which are considered most important in the management of large fires. The basic organization is first developed and then applied to a sample fire problem. As the fire progresses in size and complexity, the organization is expanded to handle the job. A base of operations is established to provide for the service and supply of all forces employed on the fire. The points for consideration are brought out as the camp is set up. A system for gathering and compiling information in a useable form is established and all functions of the fire organization are then coordinated with the plan of action to control the fire.

This film does not attempt to show fire fighting techniques, but presents the general management principles as a guide for developing an organization to be adapted to the individual requirements of each fire.

The present cost of the film is $70 for each print or $58 in quantities of 10 or more.

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Instead of coating or saturating the finished paper, as in older methods, the neoprene is now added in latex form to the pulp just before it is made into paper. The result is a new family of low-cost specialty papers made directly on the paper machine.

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Forester with thirty years' experience, largely in the Southeast, with federal, state, and commercial organizations. Hardwood and pine management, land acquisition, forest economics, and watershed management. Desires position as manager of forest lands, but qualified for research in silviculture, economics, management, and influences. Detailed information on request.
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Forestry graduate, BSF in general forestry, MSF with major in wood utilization and minor in economics, experience in West Africa in charge of purchasing organization buying mahogany and secondary species. World War II veteran, age 27, married with one child, desires permanent position with a future in an industrial or state forestry organization which will combine field work and administrative duties. References and detailed information upon request.
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Graduate forester with broad experience desires position in the Northeast. Experience includes 8 years with the U. S. Forest Service, 7 years with the Soil Conservation Service, and 2 years with private industry. Now employed as an industrial forester in the South. Age 39, married, two children.
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